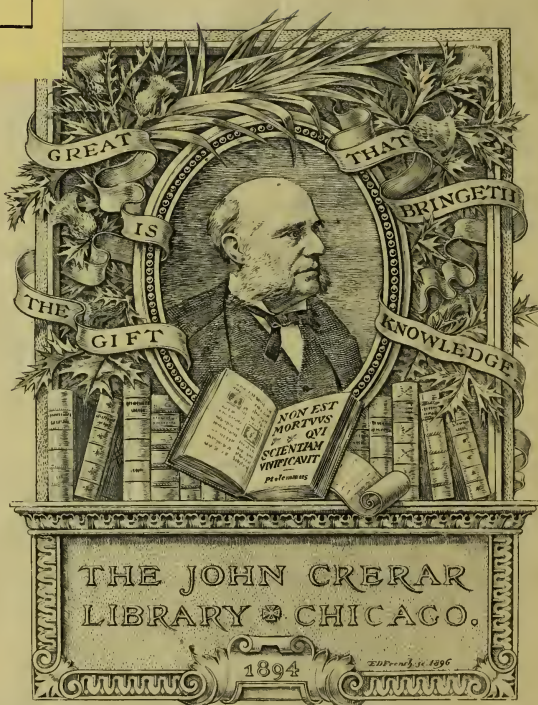


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*Bulletin of the* MONTANA STATE  
COLLEGE *of* AGRICULTURE  
*and* MECHANIC ARTS ❧ ❧  
FOUNDED EIGHTEEN HUNDRED NINETY-THREE

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VOLUME 9

FEBRUARY, 1912

NUMBER 3

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Nineteenth Annual  
Catalogue  
1911-12

Published Quarterly by the College  
Bozeman, Montana



~~Withdrawn~~

# *Nineteenth Annual Catalogue*



*Montana  
State College of Agriculture  
and Mechanic Arts*

*1911-1912*



*Bozeman, Montana*

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# Calendar

1912.

Registration and Examination for Entrance and Conditions.....	Monday and Tuesday, September 9 and 10
Instruction Begins.....	8:00 A. M., Wednesday, September 11
Receptions by Christian Associations.....	Friday, September 13
Faculty Reception to New Students.....	Friday, September 20
Music Recital.....	Friday, September 27
School of Agriculture Begins.....	Tuesday, October 8
Columbus Day, a Holiday.....	Saturday, October 12
Standing of Students Reported.....	Friday, October 25
Thanksgiving Recess.....	Thursday, Friday and Saturday, November 28, 29, 30
Standing of Students Reported.....	Friday, December 13
Freshman-Sophomore Debate.....	Friday, December 13
School of Agriculture Examinations.....	Thursday and Friday, December 19 and 20
Christmas Vacation.....	Begins 12:00 M., Friday, December 20

1913.

Vacation Ends and Second Semester School of Agriculture Begins.....	8:00 A. M., Tuesday, January 7
Examinations Begin.....	9:00 A. M., Monday, January 27
Declamatory Contest.....	Thursday, January 30
First Semester Ends.....	Friday, January 31
Examinations for Conditions.....	Friday and Saturday, January 31 and February 1
Registration for Second Semester.....	Tuesday, February 4
Lincoln's Birthday, a Holiday.....	Wednesday, February 12
Washington's Birthday, a Holiday.....	Saturday, February 22
Interscholastic Basket Ball Tournament.....	Thursday, Friday and Saturday, March 6, 7 and 8
Standing of Students Reported.....	Friday, March 14
School of Agriculture Ends.....	Friday, April 4
Oratorical Contest.....	Friday, April 18
Standing of Students Reported.....	Friday, April 25
Campus Day.....	Saturday, May 3
Arbor Day, a Holiday.....	Tuesday, May 13
Examinations Begin.....	9:00 A. M., Monday, May 26
Memorial Day, a Holiday.....	Friday, May 30
Examinations for Conditions.....	Saturday, May 31
Baccalaureate Address.....	8:00 P. M., Sunday, June 1
Field Day.....	10:30 A. M. and 2:00 P. M., Monday, June 2
Music Recital.....	8:30 P. M., Monday, June 2
Class Day Exercises.....	Tuesday, June 3
President's Reception.....	9:00 P. M., Tuesday, June 3
Commencement.....	10:30 A. M., Wednesday, June 4
Alumni Meeting and Banquet.....	Wednesday Evening, June 4

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## Montana State Board of Education

GOVERNOR EDWIN NORRIS, (ex-officio) Chairman.....Helena  
ATTORNEY GENERAL ALBERT J. GALEN, (ex-officio).....Helena  
STATE SUPT. W. E. HARMON, (ex-officio) Secretary.....Helena

### By Appointment.

WALTER S. HARTMAN.....Bozeman  
S. D. LARGENT.....Great Falls

(Term expires February, 1912.)

G. T. PAUL.....Dillon  
H. G. PICKETT.....Helena

(Term expires February, 1913.)

CHARLES H. HALL.....Missoula  
NATHAN R. LEONARD.....Butte

(Term expires February, 1914.)

O. W. McCONNELL.....Helena  
WARD H. NYE.....Billings

(Term expires February, 1915.)

G. A. KETCHAM, Clerk of Board.....Helena

## Executive Board

PRESIDENT JAMES M. HAMILTON, (ex-officio) Chairman....Bozeman

### By Appointment.

J. F. BLAIR.....Bozeman

(Term expires April, 1913.)

J. H. BAKER.....Bozeman

(Term expires April, 1915.)

GEORGE COX, Treasurer.....Bozeman

GEORGE CALLAWAY, Secretary.....Bozeman

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# Faculty

- JAMES M. HAMILTON, M. S., (Union Christian College) President.  
Professor of Philosophy and Economics.
- WILLIAM F. BREWER, A. M., (Harvard University)  
Professor of English.
- MISS LILLA A. HARKINS, M. S., (South Dakota Agricultural College)  
Professor of Domestic Science.
- ROBERT A. COOLEY, B. S., (Massachusetts Agricultural College)  
Professor of Zoology and Entomology.
- WILLIAM D. TALLMAN, B. S., (University of Wisconsin)  
Professor of Mathematics.
- WILLIAM M. COBLEIGH, A. M., (Columbia University)  
Professor of Chemistry.
- JOSEPH A. THALER, E. E., (University of Minnesota)  
Professor of Electrical Engineering
- ALFRED ATKINSON, B. S. A., (Iowa State College)  
Professor of Agronomy.
- ROBERT W. CLARK, B. S. A., (University of Minnesota)  
Professor of Animal Industry.
- CHARLES S. DEARBORN, B. S., (Kansas State Agricultural College)  
Professor of Mechanical Engineering.
- DEANE B. SWINGLE, M. S., (University of Wisconsin)  
Professor of Botany and Bacteriology.
- ROBERT D. KNEALE, C. E., (Purdue University)  
Professor of Civil Engineering.
- ORVILLE B. WHIPPLE, B. S., (Kansas State Agricultural College)  
Professor of Horticulture.
- WALTER J. TAYLOR, D. V. M., (Cornell University)  
Professor of Veterinary Science.
- FRANK W. HAM, M. S., (Montana State College)  
Professor of Physics.
- CHARLES E. MOLLET, Ph. C., (University of Kansas)  
Professor of Pharmacy.
- MRS. UNA B. HERRICK,  
Dean of Women and Instructor in Physical Education for Women.
- M. HERRICK SPAULDING, A. M., (Leland Stanford, Jr., University)  
Assistant Professor of Zoology.
- MISS HELEN R. BREWER, A. B., (Grinnell College)  
Assistant Professor of History and Latin.
- MISS MARY A. CANTWELL  
Principal of the Preparatory School and Assistant Professor of English.
- FRANK C. SNOW, C. E., (Ohio State University)  
Assistant Professor of Civil Engineering.
- HOWARD F. PATTERSON, B. S. A., (Iowa State College)  
Assistant Professor of Agronomy and Principal of School of Agriculture.

ROY C. JONES, B. S., (University of Vermont)  
 Assistant Professor of Dairying.  
 FLORENCE BALLINGER,  
 Assistant Professor of Domestic Art.  
 MISS LANA A. BALDWIN, (Women's Art School, Cooper Union, N. Y.)  
 Assistant Professor of Art.  
 GEORGE L. SULLIVAN, M. E., (University of Colorado)  
 Assistant Professor of Mechanical Engineering.  
 MISS FRIEDA BULL, M. S., (Montana State College)  
 Instructor in Mathematics.  
 HARVEY P. GRIFFIN, B. S. A., (University of Missouri)  
 Instructor in Animal Industry.  
 RALPH T. CHALLENGER, B. S., (Kansas State Agricultural College)  
 Instructor in Mechanical Engineering.  
 RUFUS A. BARNES, B. S., (University of Wisconsin)  
 Instructor in Chemistry.  
 MISS ABIGAIL M. HESS, A. B., (University of Illinois)  
 Instructor in Home Science.  
 LYMAN G. SCHERMERHORN, B. S., (Massachusetts Agricultural  
 College)  
 Instructor in Horticulture.  
 HERBERT B. BONEBRIGHT, B. S. A., (Iowa State College)  
 Instructor in Agricultural Engineering.  
 MISS CARRIE M. CEHRS, A. M., (University of Denver)  
 Instructor in German.  
 MISS FLORENCE WALLIN, A. B., (University of Iowa)  
 Instructor in French and Spanish.  
 IRWIN T. GILRUTH, A. B., (Ohio Wesleyan University)  
 Instructor in English.  
 HARRY M. JENNISON, B. S., (Massachusetts Agricultural College)  
 Instructor in Botany and Bacteriology.  
 MISS GENEVIEVE LANE (Woman's Art School, Cooper Union, N. Y.)  
 Instructor in Art.  
 MISS THEDA M. JONES,  
 Instructor in Stenography and Typewriting.  
 DRURY L. WEATHERHEAD, M. S., (University of Illinois)  
 Instructor in Chemistry.  
 FRED KATELY,  
 Assistant in Mechanical Engineering.  
 WILL T. HAINES, B. S., (Montana State College)  
 Assistant in Electrical Engineering.  
 LUCILLE HIGGINS, B. S., (Montana State College)  
 Assistant in Physics.  
 CARL GOTTSCHALCK, M. S., (Montana State College)  
 Assistant in Chemistry.  
 ERNEST A. DOCKSTADER, A. B., (Colgate University)  
 Athletic Director.

PAUL P. McNEELY, Mus. B., (Washburn College), A. B., (Kansas State University)

Director School of Music and Instructor in Piano.

U. HOLMES BISHOP, (New England Conservatory)

Instructor in Vocal Music.

MISS BLANCHE McNEELY,

Instructor in Piano.

LOUIS L. HOWARD,

Band Instructor.

MRS. MARY K. WINTER,

Librarian.

GEORGE R. CALLAWAY,

Secretary.

### STANDING COMMITTEES.

AGRICULTURE—Atkinson, Cooley, Clark, Whipple, Taylor.

ASSEMBLY—Hamilton, Bishop, Gilruth.

ATHLETICS—Swingle, Schermerhorn, Dockstader.

BUILDINGS—Clark, Mollet, Thaler.

COMMENCEMENT—Miss Cantwell, McNeely, Miss Baldwin.

ENGINEERING—Thaler, Dearborn, Kneale, Snow, Sullivan.

PUBLICATIONS—Brewer, Swingle, Kneale.

SCHEDULE—Tallman, Ham, Atkinson.

SCIENCE—Cobleigh, Tallman, Brewer, Cooley, Miss Harkins.

STUDENT AFFAIRS—Miss Brewer, Spaulding, Mrs. Herriek, Jones, Miss Ballinger.

STUDENT AID—Whipple, Miss Harkins, Mollet, Dearborn, Miss Cantwell.

## Experiment Station

### STATION STAFF.

F. B. LINFIELD, B. S. A., Director.

R. A. COOLEY, B. S., Entomologist.

ALFRED ATKINSON, B. S. A., Agronomist.

ROBERT W. CLARK, B. Agr., Animal Husbandman.

EDMUND BURKE, B. S., Chemist.

DEANE B. SWINGLE, M. S., Botanist and Bacteriologist.

O. B. WHIPPLE, B. S., Horticulturist.

W. J. TAYLOR, D. V. M., Veterinarian.

J. B. NELSON, Superintendent Dry Farm Work.

REUBEN M. PINCKNEY, B. S., A. M., Assistant Chemist.

L. F. GIESEKER, B. S., Assistant Agronomist.

WM. F. SCHOPPE, B. S., Assistant Poultryman.

H. E. MORRIS, B. S., Assistant Botanist and Bacteriologist.

J. R. PARKER, B. A., Assistant Entomologist.

LYMAN G. SCHERMERHORN, B. S., Assistant Horticulturist.



R. F. MILLER, B. S. A., Assistant in Animal Industry.

H. B. BONEBRIGHT, B. S. A., Agricultural Engineer.

M. L. WILSON, B. S. A., Assistant in Dry Farm Work.

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In connection with the college, the Montana Agricultural Experiment Station is conducted. The object of this station is to further the interests of the agricultural industries of the State of Montana. This is done by conducting researches and experiments, which may include the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their various stages of growth; the various subjects connected with irrigation; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soil and water; the chemical composition of manures, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly upon the agricultural industry of Montana as may seem advisable.

The experiment station farm, consisting of 380 acres, adjoins the college grounds. It is provided with the necessary barns, granaries, tool houses, farm implements, live stock, gardens, greenhouses and orchards.

Sub-stations for experimental work in dry farming are maintained in various parts of the state and are conducted independently or in cooperation with the United States Department of Agriculture. A sub-station for experiments in horticulture has been established in the western part of the state.

The Montana Experiment Station is supported by the annual appropriations from the Federal government under the Hatch and Adams Acts, supplemented by growing appropriations from the state.

The station issues during the year a series of bulletins, which put in practical form the results of the experimental work. These are sent, upon request, to any citizen of Montana who will apply for them, and any such may have his name entered upon a mailing list and receive all bulletins as soon as issued.

Address, Director, Experiment Station, Bozeman, Montana.

## State College of Agriculture and Mechanic Arts

The purpose of the colleges of agriculture and mechanic arts is chiefly to provide industrial education in agriculture, engineering, household economy, and applied science, for the young men and women of the

respective states in which they are located. The scope of the Montana State College is set forth in the two so-called Morrill Acts of Congress, which authorized this class of institutions and supplied in part endowment and funds for maintenance; and in an act of the Montana Legislature accepting the land and money grants from the national government.

The first Morrill Act of Congress of July 2, 1862, making a land grant for the partial endowment of the agricultural and mechanical colleges states that the income from these lands shall be used to maintain colleges "where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The second Morrill Act of Congress, August 30, 1890, making an annual appropriation out of the treasury of the United States for the further support and endowment of these colleges, provides that this fund is "to be applied only to instruction in agriculture and mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic sciences with special reference to their application to the industries of life; and to the facilities for such instruction."

The Act of the Montana Legislature, approved February 16, 1893, accepts these grants of lands and money and provides that the Montana State College shall have for its object "instruction and education in the English language, literature, and mathematics, civil and mechanical engineering, agricultural chemistry, animal and vegetable anatomy and physiology, the veterinary art, entomology, geology, and such other natural sciences as may be prescribed by the State Board of Education; political, rural and household economy, agriculture, horticulture, history, book-keeping and especially the application of science and the mechanical arts to practical agriculture in the field, and irrigation and the use of water for agricultural purposes."

### ENDOWMENT.

The Enabling Act, providing for the admission of Montana into the Union, approved February 22, 1889, Sec. 16, grants 90,000 acres of land to Montana for the use and support of an agricultural college according to the terms of the Act of Congress, July 2, 1862, and Sec. 17, grants an additional 50,000 for the same purposes, and subject to the same conditions and limitations as the other grant. The 140,000 acres of land cannot be sold for a price less than \$10.00 per acre, and the principal, together with all money received from the sale of timber, is to be invested as a permanent endowment. The unsold lands may be leased and the rentals together with the interest on the permanent endowment shall be used for the maintenance of the college.

Th Act of Congress of August 30, 1890, appropriates \$25,000 annually

out of the treasury of the United States. By the Nelson bill, passed March 3, 1907, this amount was increased annually by \$5,000 each year, beginning in 1907, until now the total annual appropriation has reached \$50,000, at which figure it is to remain.

### LOCATION.

Bozeman, the county seat of Gallatin county, is on the main line of the Northern Pacific railroad, and on a branch of the Chicago, Milwaukee and Puget Sound railroad. For convenience, healthfulness and beauty of surroundings, the location is unsurpassed. The college is situated on an elevation which commands a view of one of the most fertile valleys in the world, covered far and wide with grain fields, and hemmed in on all sides by lofty mountains.

Bozeman is a city of homes and churches, with a wholesome moral environment. It is a most desirable residence city for families who wish to educate their children. Expenses are moderate and there are all the conveniences of a modern city. The college is reached from the railroad stations and city by the electric car line.

### CAMPUS AND FARM.

The grounds and farm contain three hundred and eighty acres. Forty acres in the immediate vicinity of the buildings constitute the campus and recreation grounds, which are in lawn, interspersed with flower beds, shrubbery, trees and driveways. The remainder is used for farming and experimental purposes.

### BUILDINGS.

**College Hall**, situated in the center of the college campus is a substantial structure of brick and stone, having a total length of one hundred and twenty-eight feet and a width of ninety feet. It is three stories high and has a basement, which furnishes quarters for mechanical drawing and three class rooms. On the first floor are offices for the president and secretary, one room each for the Young Men's and the Young Women's Christian Associations, three large class rooms and the reading room and library. The north half of the second floor is devoted to the art department, the arrangement being such that three large rooms can be thrown together, by sliding doors. The south half of the second floor is used by the department of civil engineering, and has one office, one seminar room, two recitation rooms and a drawing room. The third floor contains the large assembly hall and seven class and music rooms.

**Hamilton Hall**.—This is the new dormitory for women. It was named by the faculty for the late Mrs. James M. Hamilton. It is one hundred twenty by fifty-eight feet, three stories and basement. It is constructed of brick with hard wood floors and Oregon fir finish. It is equipped with steam heat, electric lights and baths. The rooms are single and in suites, and all rooms have both hot and cold water. In the basement are the store rooms, laundry, quarters for servants, kitchen and large dining room. The first floor contains the reception rooms,

the Dean's suite, guest room and a number of rooms for students. The second and third floors are for students.

**Agricultural Hall** is a three story building, one hundred and fifty feet by sixty-eight feet, pressed brick, tile roof, maple floors and modern equipment throughout. The north half of the first floor contains the quarters for dairying, consisting of storerooms, office, class room, butter and cheese rooms and laboratories. The south half of this floor is used for horticulture and has seed room, office, class room, work room, and laboratory. The north half of the second floor is occupied by the agronomy department with office, class room, dry land office and soil and grain laboratories. In the south half are offices for the director of the experiment station, superintendent of farmers' institutes, class room, office and laboratory for the department of animal industry. The third floor is devoted to home science, and contains two large kitchen laboratories, two dining rooms, two class rooms, three sewing rooms, offices and one room for training in nursing.

Adjoining the Agricultural Hall on the south is the new greenhouse with iron frame, cement floors and modern construction throughout. In the center of the front is a palm room 39 feet square and on both sides flower and vegetable rooms 28 by 25 feet. Through the center is a plant breeding room 98 by 20 feet and on the west side a propagating room 98 by 9 feet. The entire house is 98 feet by 68 feet, and joined to the agricultural building by a brick work room 57 by 10 feet.

**The Chemistry and Physics Building** is located west of College Hall, It is sixty by one hundred feet, of pressed brick, and is three stories high including the basement. The basement is occupied by the physics lecture room, pharmacy lecture room and laboratory, the mineralogical and assay laboratory, and the museum of geology and mineralogy. The main floor is occupied by the office and department library, a lecture room, the food laboratory and the experiment station laboratory. The east half of the second story contains the laboratories for physics and the west half the qualitative and the quantitative laboratories.

**The Biology Building**, consisting of three stories and basement, is brick veneered. On the top floor is a lecture room and a museum containing the zoological collections. On the floor below are three laboratories for bacteriology, botany and zoology, and an office and work room for the botanist. The west half of the first floor is a large laboratory for general biology and the east half is occupied by the office, library and work room for the entomologist. The basement contains work rooms, class room, store rooms, herbarium room and dark room. Attached to this building on the south is a greenhouse, 72 by 50 feet, for botanical purposes, and an insectary, 18 by 10 feet, for the study of living insects. The green house is divided into two rooms, one for experimental work and the other for laboratory use.

**The Engineering Laboratory** is a two story stone building, 55 by 33 feet, with a frame annex 36 by 20 feet. The first floor contains the dynamos, motors, two steam engines and strength of material testing ma-



chines. The second story is occupied by the storage battery, photometer and electric light rooms, class room and the office of the professor of electrical engineering. The first floor of the annex contains the cement laboratories, and the second floor is used for electrical designing.

**The Shops** are in a one story frame building. The main part is 60 by 100 feet and contains a forge shop 27 by 60 feet, a machine shop 44 by 72, an office, a wash room, and a tool room. It has one wing 36 by 50 feet for woodwork, and another 36 by 48 feet for foundry.

**The Power House** is a brick building 76 by 32 feet. It contains a one hundred and twenty-five horse-power Stirling water-tube boiler, and a one hundred and twenty-five horse-power Root water-tube boiler. An eighty-five horse-power engine is directly connected with a forty K. W. dynamo to furnish power for electric lights, the ventilating fans and the shops. There is also a sixteen horse-power vertical type of engine and a ten horse-power engine which drives the fan for the power house stack.

**The Gymnasium** is a frame building 100 by 60 feet, with two rooms each 14 by 12 feet on the south end, fitted with shower and needle baths. This building is heated and lighted and has a good floor for gymnasium work. In the south end are two dressing rooms each 28 by 12 feet, with lockers. Along each side and at the ends are permanent seats, amphitheater style. The hall furnishes a convenient place for gymnasium practice, basket ball and other indoor athletics.

**The Cattle Barn** is a two story frame building 120 by 82 feet and of fine architectural appearance. On the first floor is the dairy stable, quarters for young stock, a stock judging room, 40 by 40 feet, box stalls, feed bins and offices. The second story is used for storage of hay. All stables have cement floors and iron stalls.

**The Veterinary Building** is a two story frame structure, 25 by 40 feet, with a one story wing 20 by 40 feet. On the first floor are the office of the veterinarian, two laboratories and an operating room. The second floor contains a laboratory and a class room.

**The Horse Barn** is a two story frame building 86 by 44 feet. It contains a living room, carriage room, feed bins, fourteen single stalls, three double box stalls, and space for 100 tons of hay.

**The Beef Cattle Barn** is 50 feet square with two wings each 24 by 28. It is equipped for feeding experiments and has feeding pens, space for hay, grain bins, and weighing room.

**The Sheep Barn** has a main part 40 by 50 feet and two wings, one 20 by 72 feet, the other 20 by 88 feet. In addition to the pens this building is provided with root cellar, wool and shearing rooms, hay loft, feed bins, and room for the attendant.

**The Seed Barn and Granary** is a two story building and affords ample storage room for the field crops on the station farm.

**The Piggery** consists of a main building 30 by 35 feet, with two wings, 16 by 50 feet each. In the main building are the feeding rooms



and slaughter room, while the wings provide six pens each, for the hogs.

**The Poultry Plant** consists of two buildings. One is 122 by 15 feet with a center extension 40 by 20 feet. The center contains the feed room, office, laboratory and living room. Underneath is the incubator cellar. One wing is a brooder house and the other has six pens with yards. The other house is 120 feet long and provides eight pens.

### HAMILTON HALL.

All women students whose homes are not in or near Bozeman are expected to live in Hamilton Hall. This building is completely furnished. All modern conveniences such as hot and cold water in the rooms, baths, steam heat and electric lights, are furnished. The Hall is under the supervision of the dean of women and the residents have the care and training necessary for a family of students. The price of rooms (including board) varies according to location and size of room:

One in single room.....	\$24.00
Two in single room, each.....	22.50
One in double room.....	26.00
Two in double room, each.....	23.00
Two en suite, each.....	26.00
Three en suite, each.....	24.00

The above prices are for a calendar month. Of these amounts \$18.00 is for table board and the remainder for room rent. Application for rooms in the hall may be made at any time to the dean of women, or to the secretary of the college, and must always be accompanied by a deposit of \$5.00 to insure a reservation. This amount will apply toward payment of bills in the fall or will be returned if the secretary is notified before September first. Residents who leave the Hall before the close of the semester will be required to pay the room rent till the end of the semester. Payment for room and board must be made on the fifteenth of every month in advance and after five days thereafter an extra charge of \$1.00 per week will be made as long as the bill remains unpaid, unless arrangements have been made to defer payment. Complete arrangements are made for the reception of the residents the day before registration day and no deduction will be made for late arrivals. The Hall will not be open for occupancy until the day before registration day. No deduction is made for absence at week ends or during vacations—except at the Christmas holidays, when room rent only will be paid. The residents may have guests at meals by making arrangements for same at the dean's office, the day before, and may also have the privilege of the laundry on Saturdays by paying a small fee. The residents are expected to furnish their own towel supply, dresser and table scarfs, and have same laundered, also a napkin ring and any room decorations they may fancy.

### ROOM AND BOARD FOR MEN.

There is no men's dormitory connected with the college but about twenty young men can be accommodated at the club on the campus

where rooms and board may be had for \$20.00 per month. Students who do not live in Bozeman, or at the club, find room and board in private families convenient to the college, at from \$22.00 to \$25.00 per month. The total college expense for the year, including tuition, books, room, board and incidental expenses may be estimated from \$250.00 to \$350.00. A list of approved places with prices and accommodations is kept in the president's office. A committee of students meets all trains on registration days and at other times on request, and aids in finding satisfactory locations. Students arriving in Bozeman in the day time should take car from the depot to the college.

**FEES.\***

1—Annual matriculation fee for college, preparatory, pharmacy, art, and one year home science courses.....	\$12.00
2—Annual matriculation fee for school of agriculture.....	6.00
3—Annual matriculation fee for four weeks' course in dairying.....	2.00
4—Extra fee for late registration.....	\$2.00 or \$4.00
5—Special fee for removing condition caused by absence.....	2.00

**DEPOSITS.\***

Agriculture—Agronomy (2) per semester.....	\$ 2.00
Dairy (1), (2), (a) or (c) per semester.....	2.00
Horticulture (1) per semester.....	1.50
Horticulture (4) per semester.....	5.00
Art—Art (1), (4), (5), (6), (7), (8), (9), (a) or (b) per semester.....	1.00
Art (2) or (3) per semester.....	3.00
Art (10), (11), (12), (13) or (14) per semester.....	5.00
Biology—Biology (a) or (b) per semester.....	1.00
Biology (4), (5), (6), (c) or (d) per semester.....	1.50
Biology (10) or (12) per semester.....	6.00
Biology (1), (2), (3), (9), (11) or (13) per semester.....	3.00
Chemistry—Chem. (1) per year.....	8.00
Chem. (2), (3), (4), (5), (7), (8), (9) per semester.....	8.00
Chem. (10), (11) or (12) per semester.....	6.00
Chem. (13) per semester.....	20.00
Engineering—C. E. (1), (2), (4), (11), (13), (15), (19) or (20) per semester.....	1.50
E. E. (4), (6), (10) or (12) per semester.....	3.50
Shop Work (a) per year.....	4.00
Shop Work (b) per year.....	6.00
Shop Work (d), (e), (f), (h), per semester.....	2.00
M. E. (2), (2a), (4), (4a), (9), (17), (21), (27), per semester....	2.00
M. E. (6) per semester.....	3.00
M. E. (14) or (15a) per semester.....	1.50

\*A fee is a fixed charge and no part is returned. The deposits cover the cost of materials and breakage in the laboratories and any unused balance is returned.

M. E. (20) or (28) per semester.....	5.00
Home Science—H. S. (1), (6), (8) or (h).....	3.00
H. S. (5) .....	5.00
H. S. (4).....	4.00
H. S. (2) or (g).....	5.00
Sewing (12), (13), (14), (b) or (c), per semester.....	.50
Sewing (11) per semester.....	4.00
Sewing (16) per semester.....	.75
Sewing (a) per semester.....	1.00
Sewing (e) per semester.....	1.50
Pharmacy—Phar. (1) or (10) per semester.....	4.00
Phar. (4) or (8) per semester.....	8.00
Phar. (5), (6) or (11) per semester.....	2.00
Physics—Physics (a) per year.....	1.00
Physics (1a) per year.....	2.00
Physics (2) per year.....	3.00
Physics (4) or (6) per semester.....	2.00
Physics (5) per semester.....	3.00
Typewriting—(3) or (4) for use of machine for one year.....	5.00
Veterinary Science (2) per semester.....	5.00

### ADMISSION.

Admission to the freshman class, in any of the college courses, is granted: (a) By a certificate of graduation from an accredited high school. (b) By examination in the subjects required by the college for entrance. (c) By faculty approval of grades from other than accredited high schools. (d) By graduation from the preparatory school.

Candidates for admission to the preparatory school, the one year course in domestic science and the school of agriculture, must have completed the eighth grade in the public schools or its equivalent. One year of high school work is required for admission to the school of pharmacy. There are no set requirements for music and the short agricultural courses, all being admitted who give evidence of being able to profit by the work. All candidates for admission to the institution in any department whatever are required to present the requisite diplomas or certificates for work previously done in other schools and no registration is complete until such credentials are presented and passed upon.

### ENTRANCE REQUIREMENTS.

Fifteen units are required for admission to the freshman class in any college course.

Any one with not less than thirteen units may be admitted conditionally, but the units of preparatory work which have not been offered at entrance must be given preference over college subjects.

A unit for admission shall consist of work to the amount of five recitation periods per week of forty-five minutes each or four recitation periods per week of sixty minutes each, for a year of not less than thirty-six weeks.

Two periods of laboratory, shop work, or drawing shall count as one recitation.

In accordance with the present rules of the State Board of Education the following are required of all applicants for admission without condition to the freshman classes:

- 1—English composition and literature, 4 units.
- 2—Language other than English, 2 units.
- 3—Mathematics, 2 units.
- 4—Science, 1 unit.
- 5—History, 1 unit.

The remaining units will be selected from the following:

- 1—Language other than English, 4 units.
- 2—Mathematics, 2 units.
- 3—Science, 3 units.
- 4—History, including civics and economics, 3 units.
- 5—Drawing, 2 units.
- 6—Commercial subjects, 4 units.
- 7—Industrial subjects, including home economics, mechanic arts and agriculture, 6 units.

Admission without condition to the courses in engineering and mathematics-physics requires three years of mathematics and one year of physics.

### REGISTRATION.

**Matriculation.** Students entering the college for the first time, must present their credentials or pass examination to determine their standing; and until such credentials are passed upon by the registration committee or until examinations are passed in the subjects which may be required, the applicant for admission will ordinarily not be admitted to class work. This means, in the case of graduates from accredited high schools, that diplomas must be brought to the college. In the case of graduates from the eighth grade of the common schools, the certificate of examination must be brought to the college. In case of any work for which any applicant shall ask credit, not covered by a high school diploma or an eighth grade certificate, he must bring a written statement, signed by the president, superintendent, principal, or teacher of the school where the work was taken, showing just what subjects credit is asked for, just how much time was given to such subject, and the grades attained.

**Time for Registration**—The time set for registration of students is the first Monday and Tuesday of the first semester, and the first Tuesday of the second semester. The classroom work begins on the first Wednesday morning of each semester. No students will be registered on Wednesday, Thursday or Friday of the first week of each semester, except at the convenience of class officers between four and five in the afternoon. Those who fail to present themselves for registration before the first Wednesday in either semester, will be permitted to register later in the first week, only upon the payment of a special fee of \$2.00 in addi-

tion to regular fees. Those who apply for registration after the end of the first week of each semester, will be registered only upon payment of a special fee of \$4.00 in addition to the regular fees. All special fees so collected shall go into the miscellaneous college fund. The faculty may at its discretion refund the special fee of any student, after the third month of the semester, upon definite proof that the tardy registration was necessary.

**Registration by Mail**—Most of the details of registration can be arranged in advance by mail, and students are requested to arrange their work so far as possible in this way. Those who enter the institution for the first time, should write several days in advance of the college opening, enclosing their credentials, as specified in the paragraph on matriculation above, to the president of the college, and should state the work which they wish to take. These documents will be examined and the student's classification ordinarily be determined before his arrival, so that much time in registration may be saved. Those who have been already enrolled in the institution, should send a letter to their class officers several days in advance of the registration days, telling clearly the work which they plan to take, and in the case of elective subjects, stating briefly the reasons for their choice.

If these steps are taken by students, registration should be completed with a minimum expenditure of time; but no student's registration will be complete until he applies at the college in person.

Students who plan to arrange their registration by mail as specified above, should study carefully the entrance requirements for the courses in which they are interested, and the prerequisites to the various subjects which they wish to take up.

### HOW TO REGISTER.

I. All students who have registered here before—except graduates of the preparatory department registering as freshmen—will go directly to their class officers and obtain a class entrance card.

II. Those who have not registered here before and graduates of the preparatory department will:

- (1) Fill out application blank.
- (2) Secure the signature of a member of the registration committee.
- (3) Take this signed application blank to the class officer in whose course registration is desired.
- (4) From him secure a class entrance card.

III. After securing class entrance card pay fees at secretary's office.

IV. Present class entrance card at the office of the registration committee for approval.

Unless permission is granted by the faculty, class officers will register all students in accordance with the rules governing prerequisites, failures and number of credits. The registration committee will examine all credentials for admission, and all grades earned in this and other



institutions and report any irregularities in registration to the faculty. No registration shall be considered final until approved by the committee or the faculty.

**Amount and Regularity of Work**—Students under twenty-one years of age will be admitted only to regular courses or to work as nearly regular as their preparation allows, unless on special action of the faculty. Students over twenty-one will be admitted to such work, not less than twelve credits, (allowance being made for music) as the schedule permits and their class officers approve, and the twelve credits shall include at least six credits of lecture or recitation work.

**Change of Registration**—A student desiring to change his studies will present his request to his class officer, who, after consulting all teachers interested, will take such action as he may deem best. Change in registration will be made after four weeks for extraordinary reasons only. Requests for change in registration will not be considered during the last eight weeks of a semester.

A change in course of study is allowed by a vote of the faculty only.

### ABSENCES.

Students absent from required exercises are reported at the close of each day to the president's office. Excuses for absence are not required but students are subject to discipline by the class officers' committee at any time for absences from required exercises. Whenever the number of absences in any class during a semester exceeds twice the number of credits in the course the student does not receive a passing grade in that subject until the work has been taken up. Work shall be made up by a special examination or in such other manner as the instructor may prescribe and a fee of \$2.00 must be paid to the secretary of the college before a student can make up work on account of absence, but the class officers' committee may remit the fee on recommendation of the instructor. The instructors deal with tardiness in such manner as they deem best.

**Leave of Absence.**—When it is necessary for a student to be absent from the city, application must be made to the president for leave of absence. A leave of absence is a justification for absence from class but does not give relief from the work omitted.

### GRADES.

**Passing Grades.**—Passing grades are marked A, B, C or D. An average standing from 90 to 100 is A, from 80 to 90 is B, from 70 to 80 is C and from 60 to 70 is D.

**Conditions and Failures.**—Work not of a passing grade shall be marked E, if in the judgment of the instructor it can be made up or completed without repeating the course in class. Work not of a passing grade shall be marked F, if in the judgment of the instructor it can not be made up or completed without repeating the course in class. A mark of E is a condition and may be removed by an examination or in such other manner as the instructor may prescribe. Examinations for remov-

ing conditions shall be held on the days designated in the college calendar. A mark of F is a failure and must be made up by repeating the subject in class. When a condition is not removed by the time the subject is offered the following year it lapses into a failure. The above marks apply to laboratory, shop work, drawing and other exercises, as well as to lecture and recitation courses.

Students whose work is unsatisfactory will be reported to the class officer and the president, and information will be sent to the parents or guardians.

**Credits.**—For convenience in estimating the requirements for a degree, the following rules are laid down: One hour a week, for a semester, of recitation or lecture work, or two and one-half hours a week for a semester of laboratory, shop, library work, or drawing, shall count as one credit.

If for any reason the full time is not occupied in the shop, laboratory, drawing room or library, the remainder shall be used under the supervision of the instructor for outside work.

No regular student may take in any one semester work amounting to less than twelve credits, nor more than nineteen, unless a greater number are prescribed in the course.

Grades brought by a student from another institution will be accredited in this college only after personal conference with and approval by the head of the department in which credit is desired.

### GRADUATION AND DEGREES.

**Bachelor's Degree.**—Candidates for the bachelor's degree must complete satisfactorily one of the college courses as outlined and not less than 130 credits; including also a thesis the value of which in credits shall be determined by the instructor concerned. Students who are relieved for any reason of the requirements in military drill or gymnasium shall present four additional credits in some other subjects.

The degree of Bachelor of Science is conferred upon students completing the work prescribed in any one of the college courses and the name of the course taken is placed on the diploma.

In order to complete a course satisfactorily and receive a degree a student must earn as many points as there are credits in the course. In calculating points, A grades count three times as many points as credits, B grades two times, C grades the same number and D grades zero.

All students whose points are two and one-fourth times the number of credits at the time of graduation will receive the degree "With Honors."

**Master's Degree.**—The candidate must hold a bachelor's degree from this college or another of at least equal rank, and in the line of work for which he applies for the master's degree, he shall have sufficient preparation in his major subject to enable him to carry on research work. He shall complete the full year of resident study of not less than 32 credits.

There shall be one major subject and one or two minors, the major being equal to ten credits per semester. The plan of the work must be approved by the committee on graduate work by October 1. The candidate shall also present a thesis embodying the results of original research which may be part of the credits required for the major subject.

**Engineering Degrees.**—Resident graduates in engineering may earn the degree of Civil Engineer, of Electrical Engineer, or of Mechanical Engineer, on the same basis as candidates earn the degree of Master of Science. Non-resident graduates in engineering must have at least three years of successful professional experience, must present an acceptable thesis, and must pass an examination before the special committee on degrees.

### MISCELLANEOUS.

**Government.**—Students are expected to conduct themselves as ladies and gentlemen; those who fail to comply with this demand will be requested to leave the institution.

**Work for Exhibition.**—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for the period of one year.

**Student Organizations.**—All public performances, given by students or student organizations, using the name of the college, will be under the supervision of the committee on student affairs.

So far as possible all college gatherings will be held on Friday and Saturday evenings. This includes class and student organizations. Students will not be out evenings from Monday to Friday except to attend something of unusual interest and value.

**Military Drill.**—All male students, except aliens, those physically disqualified, members of the junior and senior classes, and student assistants, are required to take military drill, satisfactory work being requisite for graduation.

**Music as an Elective.**—Music to a total of not more than four credits may be counted toward a degree in those courses which allow free electives. To those regular students who elect music the college will furnish free one thirty-minute lesson a week during the junior and senior years, or either semester of either year; and the work may be elected in either vocal or instrumental music.

Military drill is in charge of an United States Army officer and a minimum of two years drill is required. Each student in military drill must provide himself with a uniform, which is purchased through the secretary of the college, and costs about fifteen dollars.

**Assembly.**—Students are required to attend the assemblies held on the second and fourth Fridays of each month and all special assemblies. The programs at these assemblies consist of addresses, music recitals, illustrated lectures, etc. Meetings of student organizations are held on the first and third Fridays of each month.

**Honorable Dismissal.**—Students intending to sever their connection

with the institution, either indefinitely or permanently, should report as soon as possible to the president, either in person or in writing, giving proper explanation, and should apply for an honorable dismissal. Students leaving the institution without such honorable dismissal (except at the end of the college year), will not be readmitted to the college at any later time, nor will any reports or grades in credit for work done here be sent out until satisfactory explanation is made.

### COLLEGE ORGANIZATIONS.

**Young Men's Christian Association.**—The association is undenominational and is well fitted to promote the moral and religious life of students. It conducts mission and Bible study courses, and prayer meetings and secures addresses by religious workers. The association promotes good fellowship by giving social entertainments, assists new members to get started in college life and aids in securing employment for those who wish to work their way through college.

**Young Women's Christian Association.**—The object of this association is the symmetrical development of Christian womanhood. It co-operates with the Y. M. C. A. in its social and religious work among the students. It conducts devotional meetings and carries on systematic Bible study. Several delegates are sent to the Northwest Conference each year and an active interest is maintained in the state association.

**Literary Societies.**—The management of the work in inter-class and intercollegiate debating, in extemporaneous speaking, and in oratory, is now vested in a debating council, which works in co-operation with the department of English. Annual debates are now held with the Agricultural College of Utah, and the State University of Montana, and with the Montana Wesleyan University. There is an established debate each year between the freshman and sophomore classes. There is a state contest in oratory and extemporaneous address in which five institutions of the state participate.

**Engineering Society.**—The object is to aid its members financially by purchasing at wholesale rates, books, materials and instruments.

**Agricultural Society.**—All agricultural students are eligible to membership in this society. Regular meetings are held for the discussion of topics of interest to students in agriculture. The aim is to create a professional interest in scientific agriculture with special reference to the possibilities of farm life. A bookstore for the members has been conducted for several years.

**The Exponent.**—The students of the college maintain an excellent weekly paper, The Exponent, which has also a monthly literary supplement. The paper is well supported by the students and outside advertisers and has become one of the most important and successful of student enterprises. It compares favorably with the best college publications in the United States and affords the members of the staff very valuable literary training.



**Athletic Association.**—This association has general control of all athletic interests of the college, subject to the approval of the faculty. Football, baseball, basketball, track and tennis are maintained. A part of the annual matriculation fee is appropriated to athletics and all students thus become members of this association without additional cost.

**Pharmaceutical Society.**—The society was organized for the purpose of arousing a greater interest in scientific matters of practical importance to the pharmacist. Monthly meetings are held and current events in pharmacy are discussed and scientific papers and talks are presented by the instructor, students, practical pharmacists, and others.

**Branch of the American Institute of Electrical Engineers.**—A branch of this society has been organized at the college. Regular monthly meetings are held at which original papers are read or those of the Institute discussed. Students and teachers are kept in touch with practical engineers and their problems. Only regular members or student members of the American Institute are eligible to membership in this branch. There is, however, an Electrical Club which includes all the members of the Institute and all other students in the electrical engineering course.

**The Civil Engineering Society.**—The students of the department of civil engineering organized the society for the purpose of promoting their interests in matters of practical importance to engineering students and alumni. Prominent engineers who have succeeded in special fields frequently meet with the members of the society to discuss the problems of their field. Meetings are held bi-monthly.

**College Band.**—The college band of forty-five members, under the instruction of Mr. Louis Howard is one of the best amateur musical organizations in the state. The college provides instruments, music and instruction. The band is divided into two sections, beginners and experienced players. This gives a splendid opportunity for those who have never played and those who have some skill in the use of instruments.

**Glee Club.**—Men students who have the necessary range and quality of voice are admitted. Music and instruction is free. Rehearsals are held twice a week under the direction of the instructor of vocal music. College and home songs as well as the works of the foremost American composers are studied.

**Hamilton Society.**—This is a choral club composed of young women students. All are admitted who have the necessary musical ability. Practices are weekly and there is frequent opportunity for appearance on public programs.

### CONTESTS.

**Prize in Oratory.**—An annual prize of twenty dollars is given to the winner of the annual local oratorical contest. This is open to all students. The winner represents the college in the state oratorical contest.

**Armstrong Prize in Declamation.**—Hon. F. K. Armstrong, of Bozeman, gives a prize of ten dollars to the winner of the annual declamatory

contest of the preparatory school. There is also a second prize of five dollars. Only regular students are eligible.

### SCHOLARSHIPS.

The State Board of Education has established a four-year scholarship in each of the accredited high schools for the student who receives the highest average grade in his class. These scholarships are awarded each year by the high school principals for their respective schools. This scholarship excuses the holder from paying any tuition or deposits. Any one winning a scholarship may choose any of the state institutions.

### ACCREDITED HIGH SCHOOLS.

Following is a list of the accredited high schools of the state:

(1) **City High Schools.**—Anaconda, Belt, Billings, Butte, Chinook, Columbus, Forsyth, Fort Benton, Glasgow, Great Falls, Hamilton, Havre, Helena, Laurel, Plains, Pony, Stevensville, Victor, Virginia City, Whitehall.

(2) **County High Schools.**—Beaverhead, Dillon; Broadwater, Townsend; Carbon, Red Lodge; Custer, Miles City; Dawson, Glendive; Fergus, Lewistown; Flathead, Kalispell; Gallatin, Bozeman; Granite, Philipsburg; Jefferson, Boulder; Missoula, Missoula; Park, Livingston; Powell, Deer Lodge; Sweet Grass, Big Timber; Teton, Choteau.

(3) **Parochial High School,** Butte; Sacred Heart Academy, Missoula.

### EMPLOYMENT FOR STUDENTS.

A number of students earn a part of their expenses while in college. Students expecting to work their way should come with sufficient money to pay their expenses for one semester unless they have engaged work in advance. The college cannot guarantee employment, but those who are willing to give efficient, faithful service have usually found work.

A few students are employed as janitors and as assistants in the shops, laboratories and barns. Others care for furnaces, horses and cows in the city, work in stores and at various kinds of house work. Calls for young lady students to work for their board are numerous.

Students readily find employment at profitable wages during the summer vacation. A large number annually get work with the transportation companies in the Yellowstone National Park as drivers, camp-attendants and domestics. Engineering students are placed with the reclamation service, the railroads, and the electric power plants.

A faculty committee aids students to find employment. Those desiring work should write, stating experience and kind of work desired.

### LIBRARY AND READING ROOM.

**Public Depository.**—By Act of Congress the library is now a depository and receives all public documents and other printed matter issued by the United States government.

**Main Library.**—The main library is in two large, well lighted rooms on the first floor of College Hall. The library contains 11,300 volumes, not counting public documents, and about 6,000 pamphlets. It is well



supplied with standard works in technology, history, science and literature, as well as with dictionaries, cyclopedias and other reference works. About \$1,500 is spent annually for books and periodicals.

**Department Libraries.**—The agricultural library occupies two rooms, on the second floor of the Agricultural Hall. It contains almost complete bound sets of all state experiment station bulletins and United States Department of Agriculture publications, besides a large number of agricultural papers and standard works. One large room on the first floor of the biology building is used for the library and periodicals of the biological department. The library of the chemistry department is located in the office of the chemist in the chemistry building.

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### ATHLETICS AND PHYSICAL TRAINING FOR MEN.

The gymnasium is described on page 11 of this catalogue. This furnishes some room for basketball practice and games, for baseball and football practice in bad weather and for gymnasium practice of various kinds during the winter months. A small amount of apparatus is available. The college furnishes the necessary equipment and materials for basketball, football, baseball and track athletics.

The work of this department includes three main lines—the coaching of athletic teams to represent the college in outside contests; the training of such men as present themselves during the winter for work in wrestling, boxing and indoor work; and the general supervision of the physical welfare of all the students through a system of physical examination and prescribed exercises.

The college has been represented in inter-collegiate athletics during the past year by teams in basketball, track athletics, and football. Eligibility in these teams is determined under the rules of the Montana Inter-Collegiate Athletic Association.

At the middle of each college year all the students of the college are requested to present themselves for a thorough physical examination; and on the showing thus made the instructor prescribes certain forms of exercise for each student, and makes certain recommendations regarding diet and hygiene. At each recurring annual examination the improvements are noted and further suggestion made.

**Athletic Field.**—The new athletic field located south of the main building has been completed during the year. It consists of a quarter mile 20 foot cinder running track with a 130 yard straight-away. The inside field is graded for use as a football gridiron and baseball diamond. A neatly constructed grandstand with a seating capacity of 500 has been provided. During this summer the entire field will be surrounded by a substantial iron and wire fence. There are two good cement tennis courts.

### PHYSICAL EDUCATION FOR WOMEN.

The aim of the physical education department for women is to develop each girl to her highest economic value, as a unit of society, to

the end that when she finishes her college course she may carry forth into life a sane, well balanced, logical mind, high moral character and a strong symmetrical properly functioning body, capable of assuming and performing cheerfully and well the duties of cultured womanhood.

**First Year.**—Physical examination on entering. The chief aim throughout the year is to establish good posture and carriage and strengthen vital functions. The work will consist of Swedish body building work, some floor tactics, German rhythmic dancing and games.

Class exercises twice a week required.

**Second Year.**—The work for second year students will be built on first year's work. Light apparatus, folk dancing, gymnasium games.

Class exercises twice a week required.

All through the two years the course includes lectures on personal hygiene; general deportment for girls; dress from the standpoint of health and appearance; the physiology of bodily exercise. The regulation gymnasium suit and shoes, which may be obtained from a local dealer will be required.

### **BASKET BALL TOURNAMENT AND SPEAKING CONTEST.**

The annual high school basket ball tournament and speaking contest is held on Thursday, Friday and Saturday nearest the tenth of March. The railroad fares and the room and board for three days in Bozeman are paid for six basketball players and one speaker from each high school. All accredited high schools are eligible to participate. Rules of eligibility are determined and protests decided by the Montana High School Athletic Association. A cup is awarded the champion team. In connection with the tournament an extemporaneous speaking contest is held.

### **ORGANIZATION OF INSTRUCTION.**

A. The following four-year college courses, each leading to the degree of Bachelor of Science, are offered:

1—Division of Agriculture.

1, Agronomy; 2, Animal Industry and Dairying; 3, Horticulture.

2—Division of Engineering.

1, Civil Engineering; 2, Electrical Engineering; 3, Mechanical Engineering.

3—Division of science.

1, Biology; 2, Chemistry; 3, Home Science; 4, History-Literature;

5, Mathematics-Physics; 6, Secretarial.

B. The following courses, not leading to a bachelor's degree are offered:

1—Preparatory School.

2—School of Agriculture.

3—School of Pharmacy with the degree of Ph. C.

4—Art School.

5—Music School.

C. The following special courses are offered:

1—Household Economy, one year.

- 2—Dairying, four weeks.
- 3—Livestock, two weeks.
- 4—Poultry, one week.
- 5—Course for women, two weeks.

### NOTATION.

In the following tables and descriptions of courses the signs used are as follows: All numbers given in the parentheses are the numbers of the courses and the description of the work may be found by these numbers. So the notation (Math. 3) means that the course referred to is the course in mathematics numbered 3 which is analytical geometry and calculus. The letters of the alphabet without numbers are used in parentheses in the same way to indicate courses of sub-freshman rank. The arabic numbers used without parentheses in the tables and in the description of the courses indicate the number of credits toward graduation allowed for the subject. In the description of the courses the Roman numerals, I and II are used to designate the first and second semesters. M., T., W., Th., F., and S., are used to indicate the working days of the week, and the numerals "10 to 11" or "3 to 4" to indicate the morning or afternoon hours. In the case of elective subjects, no hours are given. The time of the recitations for elective subjects will be announced as the work is called for.

## Division of Agriculture

Four-year courses are maintained in (1) Agronomy, (2) Animal Industry and Dairying, (3) Horticulture. The aim is to give a scientific and practical training for the agriculturist, the stockman, the dairyman and the horticulturist. The work is the same for the first two years. At the beginning of the junior year the student chooses the group in which he desires to specialize. The completion of the new agricultural building, the purchase of additional lands, and the erection of farm buildings and barns, afford ample accommodation for the agricultural work. The equipment and other facilities are described in connection with the courses of study.

**AGRICULTURE.**

**FRESHMAN YEAR.**

First Semester.	Second Semester.
English Composition (Eng. 1).....2	English Composition (Eng. 1.).....2
Public Speaking (Eng. 4).....1	Public Speaking (Eng. 4).....1
General Chemistry (Chem. 1).....4	General Chemistry (Chem. 1).....4
General Botany (Biol. 9).....5	Plant Physiology and Histology (Biol. 10).....4
Trig. and Log. (Math. 2a).....3	Prin. Plant Culture (Hort. 1).....3
Farm Dairying (An. Ind. 8).....3	Animal Types (An. Ind. 1).....3
Drill .....1	Drill .....1
—	—
19	18

**SOPHOMORE YEAR.**

Expository Composition (Eng. 2) 2	Expository Composition (Eng. 2) 2
Qualitative Analysis (Chem. 2)... 4	Organic Chemistry (Chem. 5).... 5
Gen. Des. Phys. (Phys. 1a)..... 3	Gen. Des. Phys. (Phys. 1a)..... 3
Invertebrate Zoology (Biol. 1).... 4	Animal Phys. and Anat. (Biol. 3) 5
Field Crops (Agron. 1)..... 5	Geology (Geol. 1)..... 3
Drill ..... 1	Drill ..... 1
—	—
19	19

## Course in Agronomy

Agronomy is the science of the field and its crops. It treats of the production and improvement of field crops, the cultivation of soils and the maintenance of their fertility, and general farm management, which is the application of economic business methods to farm practices.

Because of the peculiar agricultural conditions existing in western states, a new agriculture is being developed. The handling of dry farming lands is necessary only in the West. The problems which have to do with irrigation water, and the cultivation of the soil and management of the crops under irrigation must be solved by the western investigators and agriculturists. It is to fit men to deal with these and other questions of production on the farm that this course is offered.

The first two years of the agronomy course are devoted to the study of the natural sciences, languages and some general agricultural work. This places the student in a position to appreciate and intelligently discuss the methods of practice taken up later in the course.

The last two years of the course are designed to give the student clear insight into methods for the cultivation and maintenance of the fertility of the soil; the peculiarities of the growth and handling of different crops; the arrangement, the laying out of the farm, and the principles which govern successful farm management.

With a constantly growing appreciation of the value of the agricultural lands of the West, comes an active demand for young men trained along the lines of practical and scientific agronomy, men who combine college training with practical experience and native ability. Such training is offered to young men in this course. The demand for such students is unlimited, at a compensation not exceeded in any other calling. A few of the many lines open to graduates of this department are: college and experiment station work, agricultural journalism, management of large irrigated and dry farms, management and salesmanship for seed firms, and superintendencies for companies with large land holdings.



**AGRONOMY.**

**JUNIOR YEAR.**

First Semester.		Second Semester.	
Economics (Econ. 3).....	2	Economics (Econ. 3).....	2
Soil Physics (Agron. 2).....	5	Soil Fertility (Agron. 3).....	3
Agricultural Chemistry (Chem. 7) 4		Farm Mechanics (Agron. 4).....	3
Bacteriology (Biol. 12).....	5	Plant Pathology (Biol. 11).....	4
Elective.....	2 or 3	Care and Management of Live Stock (An. Ind. 6).....	3
		Organic Evolution (Biol. 14).....	2
		Elective .....	2
<hr/>		<hr/>	
18 or 19		19	

**SENIOR YEAR.**

Farm Management (Agron. 6)....	4	Principles of Breeding (Agron. 7) 4	
General Entomology (Biol. 4)....	4	Soil Management (Agron. 8).....	2
Plane Surveying (C. E. 1).....	5	Sanitary Science (Vet. Sci. 6)....	2
Thesis (Agron. 9).....	2	Feeding Live Stock (An. Ind. 4) 3	
Elective .....	4	Advanced Grain Judging (Agron. 5) .....	2
<hr/>		Thesis (Agron. 9).....	2
18 or 19		Elective .....	4
		<hr/>	
		19	

## Course in Animal Industry and Dairying

The work in animal industry consists of study in judging, feeding, breeding and caring for farm animals. The work in dairying consists of the handling, manufacture and marketing of milk and its various products.

This course is designed to prepare young men for agricultural college and experiment station work, federal government work, farmers' institute work, positions as buyers and salesmen of livestock, teachers of animal industry and dairying in high schools, managers of large livestock and dairy farms, creamery and dairy inspectors, managers of dairy corporations, and community milk depots; and above all, to furnish men with a scientific as well as a practical knowledge to operate their own farms in Montana.

The first two years of this course are given largely to a study of basic subjects, as English composition, mathematics, physics, chemistry, and biology. The last two years are given to special practical and theoretical work in dairy manufactures, handling of milk, judging and feeding live stock, veterinary science, bacteriology and other allied subjects.

This course is given through text books, lectures, practice and observation. Lectures are given by specialists and the student is made familiar with the most modern ideas and acquainted with the methods of the most successful breeders, feeders and dairymen in this and European countries. The work in judging is given by the use of college animals and stereopticon lectures. To secure a variety of animals, excursions are made to stock farms near the college. Advantage is also taken of the live stock on exhibition at the state and local fairs. Practical instruction is also given in compounding rations, making out pedigrees and keeping breeding records.

The theoretical work in dairying is closely followed with practical work in handling separators, testing milk, ripening and churning cream, and by all the actual work in the college creamery and cheese factory. The practical and theoretical are carefully combined.

**ANIMAL INDUSTRY—DAIRYING.****JUNIOR YEAR.****First Semester.**

Agricultural Chemistry (Chem. 7)	4
Breeds of Live Stock (An. Ind. 2)	4
Milk and Milk Testing (An. Ind. 9)	3
Bacteriology (Biol. 12)	5
Veterinary Physiology (Vet. Sci. 1)	3

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**Second Semester.**

Animal Nutrition (Chem. 11)	3
Poultry (An. Ind. 7)	3
Veterinary Anatomy (Vet. Sci. 2)	3
Vertebrate Zoology (Biol. 2)	4
Organic Evolution (Biol. 14)	2
Dairy Manufactures (An. Ind. 10)	4
or Soil Fertility (Agron. 3)	3

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 18 or 19
**SENIOR YEAR.**

Care and Management of Live Stock (An. Ind. 6)	3
Obstetrics (Vet. Sci. 4)	3
Stock Judging (An. Ind. 3)	2
Herd Books and Pedigrees (An. Ind. 5)	1
Embryology (Biol. 13)	4
Thesis (An. Ind. 12)	2
Elective	4

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Care and Management of Live Stock (An. Ind. 6)	3
Principles of Breeding (Agron. 7)	4
Stock Judging (An. Ind. 3)	2
or Cheese Making (An. Ind. 11)	3
Pathology (Vet. Sci. 3)	3
Feeding of Live Stock (An. Ind. 4)	3
Thesis (An. Ind. 12)	2
Elective	2 or 3

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## Horticulture

The four years' course in horticulture, leading to the degree of Bachelor of Science in horticulture, is designed to prepare students as teachers in agricultural colleges, investigators in the agricultural experiment stations, editors of horticultural papers, managers of fruit associations and superintendents of commercial orchards and fruit plantations. The western United States leads the world in methods of orcharding and disposing of orchard products, and there is a strong and growing demand for persons properly trained to manage the orchard projects now operated throughout the fruit regions of the west. Fruit growing, when done in a scientific way, is extremely profitable and presents an inviting field for the trained horticulturist. The college offers good facilities for a thorough training in all branches of horticulture.

**HORTICULTURE.****JUNIOR YEAR.**

## First Semester.

Economics (Econ. 3).....	2
Soil Physics (Agron. 2).....	5
Bacteriology (Biol. 12).....	5
Agricultural Chemistry (Chem.	
7) .....	4
Systematic Pomology (Hort. 4)	3

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19

## Second Semester.

Economics (Econ. 3).....	3
Soil Fertility (Agron. 3).....	3
Plant Pathology (Biol. 11).....	4
Vegetable Gardening and Small	
Fruit Culture (Hort. 3).....	5
Organic Evolution (Biol. 14).....	2
Elective .....	3 or 4

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20 or 21**SENIOR YEAR.**

General Entomology (Biol. 4)....	4
Greenhouse Construction and	
Management (Hort. 5).....	3
Commercial Fruit Growing	
(Hort. 7) .....	3
Plane Surveying (C. E. 1).....	5
Thesis (Hort. 8).....	2
Elective .....	3

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20

Landscape Gardening (Hort. 6)	3
Pomology (Hort. 2) .....	3
Principles of Breeding (Agron.	
7) .....	4
Sanitary Science (Vet. Sci. 6)....	2
Thesis (Hort. 8) .....	2
Elective .....	3 or 4

17 or 18

**AGRONOMY.****Professor Atkinson.****Assistant Professor Patterson.****Mr. Bonebright.**

On the main floor of Agricultural Hall are the soil and grain laboratories and class rooms modern and thoroughly equipped.

The soil laboratory, accommodating forty-eight students, provides for accurate work in soil physics and soil fertility. Upwards of two thousand dollars have been expended in equipping these laboratories with the most up-to-date fittings and apparatus, in order that the students may enjoy the very best facilities.

In the grain laboratory, specially designed individual judging tables have been installed. This permits each student to pursue careful and continuous work in grain judging and enables him to become thoroughly familiar with the various grain standards. Vermin proof storage cases for class materials and standard samples have been provided. These insure the preservation of valuable material as accumulated. Score cards based on Montana conditions have been prepared for wheat, oats, barley and corn, and are used to impress students with the points to be looked for in grain judging work.

A portion of the space in the greenhouses is given over to pot culture and germination work. Plots on the college farm are available for student work.

(1) **Field Crops.**—A study of grain crops, root crops, sugar, fibre, and other classes of field crops which may be grown in Montana. The history, classification, management, uses and the possible manufactured products are fully discussed. In this course the students become familiar with the various commercial grain standards and have considerable grain judging practice with the score card. Prerequisite: Biology (9) and (10). Lectures, 3; laboratory, 2. I, 5. M. W. F., 9 to 10; T. Th., 8 to 10.

(2) **Soil Physics.**—This course is designed to prepare the students to understand better the effects of the different methods of treating soils, and the influence of these upon moisture, texture, aeration, fertility and production. It comprises a review of the origin, formation and classification of soils and study of the conditions influencing the supply of heat, air and moisture as related to growing plants. The work of the class room is supplemented by laboratory work comprising the determination of such questions as the water holding capacity and capillary power of various soils, and the effect of mulches and of various systems of rotation on the physical condition of the soil. Prerequisite: Physics (1a); geology (1); chemistry (5). Lectures 3; laboratory 2. M. T. Th., 1 to 3.

(3) **Soil Fertility.**—Maintenance of fertility, fertilizers and rotation. The influence of barnyard manure, green manuring and commercial fertilizers upon the quality and yield of the soil and upon succeeding crops, different rotations and the ultimate effect of different methods of



farm management upon the fertility and productive capacity of the soil, and also a study of the preservation of barnyard manure. Prerequisites: Agronomy (2), chemistry (7), biology (12). II, 3. M. W. F., 9 to 10.

(4) **Farm Mechanics.**—Includes the study of the development, construction, functions and methods of operating, adjusting and repairing implements and farm machinery; also a study of the principles of draft and the production of power, and the care and operation of such farm power machinery as the windmill, gasoline engine, and the different makes of traction plowing machinery. Prerequisites: Physics (1a), agronomy (1 and 2). Lectures 2; laboratory 1. II, 3. W. F., 10 to 11. Th., 8 to 10.

(5) **Advanced Grain Judging.**—In this course is given constant practice in judging cereal, grass and forage seeds. Prerequisite: Agronomy (1). Laboratory 2. II, 2. T. Th. 1 to 3:30.

(6) **Farm Management.**—This course considers the problems of farm management. The relative profits of different systems of farm management, the relation of the industry of agriculture to other industries, and the social conditions of agriculture are considered. Prerequisites: Agronomy (1, 2, 3, 4), animal industry (6). I, 4. M. T. W. Th., 11 to 12.

(7) **Principles of Breeding.**—This course considers the different theories of plant and animal improvement, and embraces a study of selection, heredity, variation, atavism and fecundity; also cross breeding and in-breeding with a historical study of their results. Prerequisite: Biology (14). Lectures, 4. II.

(8) **Soil Management.**—This course includes a study of the most approved methods of handling various soils in their relation to crop production. It embraces a study of alkali, sandy, heavy clay, gumbo, muck, peat and old worn out soils, as well as a study of the management of irrigated and dry farm lands. Prerequisite: Agronomy (1, 2, 3). II, 2. T. Th., 9 to 10.

(9) **Thesis.**—Agronomy students are required to prepare a graduating thesis on some subject to be approved by the head of the agronomy department. The subject of this thesis must be decided upon not later than November 15th, of the senior year, and the thesis must include considerable research and experimental work on the part of the student. I and II, 4.

## ANIMAL INDUSTRY AND DAIRYING.

Professor Clark,  
Assistant Professor Jones,  
Mr. Schoppe.  
Mr. Griffin.

For the work in animal industry there is available a herd of thirty-five dairy cows, herds of pure bred cattle, Herefords, Shorthorns, Angus, Holsteins, Ayrshires and Jerseys, Percheron horses, pure bred Berkshire, Poland China and Yorkshire swine, and Shropshire, Rambouillet and Cotswold sheep. During the winter season the live stock used in the feeding experiments is also available for study. For the poultry work nine breeds of fowls are kept.

The cattle barn is a two story frame building with two wings extending to the south. One of these wings is used for the dairy cows and breeding stock, and the other for bulls, young stock and calves. Between these two rooms is located a stock judging pavilion forty feet square. The second story of the main barn is used for the storage of hay. The first story provides feeding rooms, storage for grain and box stalls.

The horse barn is a two story frame building with stalls for twelve horses, carriage and feed rooms, and capacity of 100 tons of hay.

The piggery consists of a main building thirty by thirty-five feet, with two wings sixteen by fifty feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each.

The poultry buildings include two main buildings, one seventy-two by sixteen feet, with twelve pens; the other one hundred and twenty-eight feet long with eight pens; with yards one hundred feet long on either side, and a brooder house thirty-six by sixteen feet. These buildings are connected by a feed room, fourteen by twenty feet, under which is an incubator cellar and a heating plant for the building.

The dairy is equipped with all modern appliances for the manufacture of butter and cheese. Eight hand separators afford the students an opportunity to compare the merits and demerits of the different types.

In churns there are the Perfection, Disbrow and Simplex. These are all combined churns and butter workers, yet are entirely different in style. In addition, the butter room is equipped with all modern appliances for handling milk and cream, such as cream vats, tempering vats, Wizard and Jensen ripeners, starter cans, and Bohn refrigerator together with all things necessary for the manufacture of butter in an up-to-date plant.

The creamery is equipped with a 5 horse power boiler and a 5 horse power electric motor, and in the practical work each student takes his turn in handling these machines.

The cheese room is 30 by 30 feet with curing rooms 20 by 20 feet; in the former there are cheese vats, gang and upright presses and all necessary hoops and equipment for the manufacture of all varieties of American Cheddar cheese. In this department there is made both Edam and Brick cheese, but special emphasis is placed on the manufacture of the American cheese.

The testing laboratory is very thoroughly equipped with different styles of Babcock testers (both hand and steam) and all necessary glassware for the testing of milk, cream, butter, cheese, skim milk, whey, etc.

Different tests for the determination of moisture in butter have been added as well as a complete equipment for acidimetry.

(1) **Animal Types.**—A study of types as related to production and work. This course covers the judging of the different market classes of cattle, (beef and dairy), of sheep, (mutton and wool), of horses, (light and heavy), and of hogs, (bacon and fat.) The entire time of this course is given to practical handling and judging of the stock in the stock pavilion. Laboratory 3. II, 3. T. W. Th., 1 to 3:30.

(2) **Breeds of Live Stock.**—A study of the development of the breeds of horses, cattle, swine and sheep will illustrate the principles and particular characteristics, and distinguish one breed from another, and will show the adaptability of each particular breed to various climates, conditions and purposes. These lectures will be illustrated by stereopticon views of characteristic animals of the different breeds. Lectures, 3; laboratory, 1. I, 4. M., 11 to 12; T. Th., 10 to 11; Th., 1 to 3:30.

(3) **Stock Judging.**—Animal measurements and the systematic study of animal form, function, and performance; the aim being to give exact and intimate acquaintance with the detailed form of specialized types, a knowledge that is essential to the highest success in selection and breeding; also some systematic work in the judging of groups of cattle, horses, sheep and swine, similar to those found at county and state fairs. Lecture, 1; laboratory, 1. I and II, 4.

(4) **Feeding Live Stock.**—The principles underlying the profitable feeding of animals. The composition of plants, animals and animal products. The practice that gives best results as indicated by available data gathered from the work of experiment stations in this and other countries. II, 3.

(5) **Herd Books and Pedigrees.**—This is largely a laboratory study of the herd books of different breeds of live stock. The tabulation of pedigrees is practiced, and such other exercises as will enable the student to learn the value of a pedigree and show how to keep the record of a breeding herd. I, 1.

(6) **Care and Management of Live Stock.**—A special study of the methods to be followed in the breeding, feeding and development of the various classes of live stock as illustrated from the practices of the most successful stock breeders. Lectures 2; laboratory 1. I and II, 6. T. Th., 9 to 10; M., 1 to 3:30.

(7) **Poultry.**—Breeds and management; poultry houses; feeding and care of poultry; the operation of incubators and brooders. II, 3.

(8) **Farm Dairying.**—This course comprises a study of the subject of dairying and its general relation to the farm. The class of work takes up production of milk, separation of cream by gravity and separator; the preparation of starters; the ripening and churning of cream; the packing and marketing of butter. The use of the Babcock tester is also discussed with particular reference to its use on the farm; also the construction of the milk house and stables with regard to sanitary conditions as well as to utility. Lectures, 2; laboratory, 1. I, 3.

(9) **Milk and Milk Testing.**—This course comprises a study of milk, its secretion, composition, and uses; pasteurization; separation and handling for city milk trade; the care of milk for creamery or cheese factory; the testing of variations and adulterations; the testing of butter and cheese; and the use of the acidimeter. Reference books used: Milk and Milk Testing, by Farrington & Wall; Modern Methods of Testing Milk and Its Products, by Van Slyke; and Dairy Laboratory Guide, by Melick. Lectures, 2; laboratory, 1. I, 3. M. W., 9 to 10. M., 1 to 3:30.

(10) **Dairy Manufactures.**—This course comprises advanced work in butter making, the scoring of butter and cheese, factory management and accounting, milk inspection, and the preparation of ice cream and ices.

This course is also intended to give the student a general knowledge of the different ways in which milk and its products are utilized outside of the scope ordinarily considered under dairying; such subjects as the preparation of condensed, certified, modified, and hygienic milk. Reference books used: *The Principles and Practices of Butter Making*, by McKay and Larson; and *Jensen's Milk Hygiene*, by Pearson. Lectures, 1; laboratory, 3. II, 4.

(11) **Cheese Making.**—The equipment for factory and home cheese making, the principles and practice necessary to make a uniform article and methods used to overcome characteristic difficulties are explained and illustrated in the class room and laboratory. All common varieties of cheese, such as Cheddar, Swiss, Brick and Limburger, are discussed, and as far as possible made in the cheese room, but the Cheddar cheese making is particularly emphasized. Reference books: *Cheese Making*, by Decker; and *The Science and Practice of Cheese Making*, by Van Slyke & Publow. Laboratory, 3. II, 3.

(12) **Thesis.**—During the senior year each student is required to prepare a thesis. This must be original work by the student, who must consult with the instructor in charge regarding subject. I and II, 4.

Professor Whipple.

Mr. Schermerhorn.

(1) **Principles of Plant Culture.**—A course designed for all students in agriculture, and others interested in the subject of plant production. The time is given largely to the study of the principles and practice of plant propagation, including practical work on the propagation of plants by spores, seeds, cuttings, layers, graftage and other methods of lesser importance; methods of gathering and storing seeds and their influence upon germination; transplanting, principles, methods and influence upon the growth of plants. Prerequisite: Biology (9). Lectures, 2; laboratory, 1. II, 3.

(2) **Pomology.**—This course is designed for horticulture students, and deals with the principles and practice of pruning tree-fruits, grapes and small fruits; the physiology of pruning; the fruit bearing habits of plants and their relation to pruning; the effect of ringing, bending and thinning fruit; pruning young trees, dwarf trees and mature trees—these subjects will be treated in text book, lectures and practice work. Prerequisites: Hort. (1), Biol. (10). II, 3.

(3) **Vegetable Gardening and Small Fruit Culture.**—This course deals with the principles of vegetable gardening and small fruit culture, as well as with the practical side of the subjects. The growing of vegetables in the garden and greenhouse will be discussed. The growing of small fruits adapted to Montana conditions will be taken up in detail. The subjects will be treated in text book, lectures and practice work. Prerequisites: Hort. (1), Biol. (10), Agron. (2). II, 5. M. T. W. Th. F.,



9 to 10.

(4) **Systematic Pomology.**—This course takes up the systematic side of pomology, the description and naming of varieties of fruit. Considerable time will also be devoted to the judging of exhibition fruit and discussion of score cards. The latter part of the course will be devoted to a study of the evolution of cultivated plants, especially fruits. Prerequisites: Hort. (1), Biol. (9). Lectures 2; laboratory 1. I, 3.

(5) **Green House Construction and Management.**—The construction, heating and maintaining of greenhouses, with lectures and practice treating of the methods of growing plants in greenhouses and conservatories. Prerequisites: Hort. (1) and (3), Agron. (2) and (3). I, 3.

(6) **Landscape Gardening.**—The laying out and planting of private and public grounds are discussed. The trees, shrubs and flowers suited to Montana conditions are studied. Lectures, 2; laboratory, 1. II, 3.

(7) **Commercial Fruit Growing.**—In this course the methods of planting, cultivating, irrigating and managing commercial orchards are discussed in the class room and orchard. The methods of picking, grading, packing and marketing fruits are important phases of the course. Prerequisites: Hort. (1) and (4), Agron. (2) and (3). Lectures, 2; laboratory, 1. I, 3. T. Th., 8 to 9.

(8) **Thesis.**—Horticultural students are required to prepare a thesis during the senior year, two credits running throughout the year being allowed for this work. The subject of the thesis must be approved by the head of the horticultural department and must be decided upon not later than November 15th of the senior year. I and II, 4.

## VETERINARY SCIENCE.

Dr. Taylor.

(1) **Veterinary Physiology.**—A course in animal physiology dealing with the prehension of foods as observed in the various domestic animals. Also the digestion, assimilation and uses of the various foods, the circulation of the blood and its function, the nervous system, the sense of sight and the phenomenon of locomotion. Prerequisite: Biology (3). Text book, *A Manual of Veterinary Physiology*, by Captain F. Smith. I, 3.

(2) **Anatomy.**—Lectures and laboratory work dealing with the bony framework of the body and its muscles. Special emphasis is laid upon a thorough study of the thoracic and abdominal organs and organs of reproduction. Prerequisite: Veterinary Science (1). Text book: Chauveau's *Comparative Anatomy of the Domesticated Animals*. II, 3.

(3) **Pathology.**—This course is designed to make the student familiar with the normal and pathological tissues. Gross and microscopical specimens will be used for demonstration. Prerequisite: Vet. Sci. (2). II, 3.

(4) **Obstetrics.**—Diseases of animals incident to reproduction. Emphasis will be put especially upon normal presentations and reduction of dystokia. Prerequisite: Veterinary science (2). Text book: Williams's *Veterinary Obstetrics*. I, 3.

(5) **Materia Medica.**—A comprehensive study of the combination of

the more common drugs in the treatment of farm animals. Prerequisite: Biology (9). I, 2.

(6) **Sanitary Science.**—This course deals with the care and handling of animals affected with communicable diseases. It will also include a few lectures upon sanitary police, or inter-state shipment, and on farm sanitation. Text book: Law's Veterinary Medicine, Vol. IV. II, 2. T. Th., 10 to 11.

(7) **Common Diseases of Animals.**—On the causes, prevention and treatment of the more common diseases of animals. II, 3.



## Division of Engineering

The purpose of the courses offered in the division of engineering is to furnish the student the fundamental training essential to a successful engineer. This result is accomplished, not alone by the study of the theoretical, but by giving attention to the practical application of the principles involved. A limited degree of flexibility is given in some of the courses through electives, thus enabling the student to specialize in any chosen line of work.

Courses are offered in civil engineering, electrical engineering and mechanical engineering, leading respectively to the degree of Bachelor of Science in civil, electrical and mechanical engineering, and post graduate courses leading respectively to the degree of Civil Engineer, Electrical Engineer and Mechanical Engineer.

## Civil Engineering

This course is designed to prepare the student to practice the profession of civil engineering in its following branches: Structural and architectural engineering; street, highway and railway engineering; water power development; irrigation, drainage and water supply engineering; city engineering; sanitary engineering; plotting, mapping, surveying, etc. The technical subjects which give proficiency in the above branches are supplemented by a thorough study of capital, labor and labor organizations, banking, cost, cost keeping, contracts, specifications, and other legal phases of engineering. Consequently the graduate is enabled to gain compensation, not only through wages and fees, but also as an engineering promoter, as a contractor, or as a consulting engineer.

A student who desires to specialize in architecture, or in sanitary science, is allowed to so arrange his electives that he may graduate as an architectural engineer, or as a sanitary engineer.

All civil engineering students will take the sub-courses listed on page 41. In addition to these subjects, the regular student will take Math. (5) and (6); Chem. (14); Geol. (1); C. E. (4), (11), (17), (20), (24) and (25); the student of architecture will take art (3) and (7); Hort. (6); C. E. (32), (33), (34), (35) and (36); and the student of sanitary engineering will take Biol. (9) and (12); and Chem. (3), (4), (5) and (10); and C. E. (33).

Each student is expected to engage in practical engineering work during his summer vacations, and is assisted in securing such positions as he may be able to fill.

## CIVIL ENGINEERING.

### FRESHMAN YEAR.

#### First Semester.

English Composition (Eng. 1)....	1
Algebra (Math. 1).....	3
Trigonometry (Math. 2).....	2
General Chemistry* (Chem. 1)....	4
Elementary Drawing (C. E. 2)....	3
Public Speaking (Eng. 4).....	1
Woodwork† (M. E. 2).....	2
Foundry† (M. E. 4).....	1
Military Drill.....	1

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19

#### Second Semester.

English Composition (Eng. 1).....	2
Analytical Geometry (Math. 3).. <td>4</td>	4
Descriptive Geometry (M. E. 3)	5
General Chemistry* (Chem. 1)....	4
Public Speaking (Eng. 4).....	1
Concrete and Cement (C. E. 15)	2
Military Drill .....	1

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19

### SOPHOMORE YEAR.

English Composition (Eng. 2)....	2
Calculus (Math. 4).....	5
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2) .....	2
Plane Surveying (C. E. 5).....	5
Elective .....	2
Military Drill .....	1

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20

Calculus (Math. 4).....	5
Electrical Machinery (E. E. 1)....	2
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2) .....	2
Elective .....	6
Military Drill.....	1

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19

### JUNIOR YEAR.

Mechanics (C. E. 5).....	4
Hydraulics (C. E. 8).....	3
Irrigation Engineering (C. E. 9)	3
Seminar (C. E. 12).....	1
Elective .....	5 or 9

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19 or 20

Mechanics (C. E. 5).....	4
Strength of Materials (M. E. 14) .....	1
Structural Engineering (C. E. 13) .....	5
Sanitary Engineering (C. E. 14)	3
Contracts and Specifications (C. E. 23).....	2
Seminar (C. E. 12).....	1
Elective .....	3

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19

### SENIOR YEAR.

Economics (Econ. 3).....	2
Water Power Dev. (C. E. 18).....	3
Engineering Design (C. E. 19)....	3
Found. and Masonry (C. E. 21)	3
Seminar (C. E. 1).....	1
Elective .....	7

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19

Economics (Econ. 3).....	2
Municipal Engineering (C. E. 19)	3
Engineering Design (C. E. 19)....	3
Seminar (C. E. 12).....	1
Thesis (C. E. 27).....	5
Elective .....	5

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19

\*Foreign language for students of architectural engineering.

†Or 3 credits of architectural drafting.

## Electrical Engineering

This course provides a thorough technical training in electrical engineering. The rapid development of electrical engineering is largely due to the use of sound theory in the solution of commercial problems. For this reason the theoretical subjects, and the application of theory to the solution of practical problems are emphasized.

The course is designed to teach students the scientific laws and principles forming the basis of the profession, and the application of these laws and principles to commercial problems. The general training consists of courses in mathematics, physics, chemistry, drawing and shop work. The electro-technical work consists of lectures and recitations on the theory of electrical phenomena, and on problems in the design, construction and operation of electrical machines and apparatus. Conventional methods are used in drawing and designing, and the experimental tests made in the laboratory are essentially similar to the tests made by large manufacturing companies. The apparatus and instruments used are of modern commercial types.

A limited number of electives is offered during the sophomore, junior and senior years. Students may choose their electives by consultation with the head of the department.

The course is supplemented by an annual inspection trip to some of the large power plants of Montana, and by lectures by prominent electrical engineers.

**ELECTRICAL ENGINEERING.****FRESHMAN YEAR.****First Semester.**

English Composition (Eng. 1)....	2
Algebra (Math. 1).....	3
Trigonometry (Math. 2).....	2
Public Speaking (Eng. 4).....	1
General Chemistry (Chem. 1).....	4
Elementary Drawing (E. E. 21) 3	
Woodwork (M. E. 2).....	2
Foundry (M. E. 4).....	1
Military Drill.....	1

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**Second Semester.**

English Composition (Eng. 1)....	2
Analytical Geometry (Math. 3)....	4
Descriptive Geometry (M. E. 3) 5	
Public Speaking (Eng. 4).....	1
General Chemistry (Chem. 1).....	4
Foundry (M. E. 4a).....	1
Pattern Work (M. E. 2a).....	1
Military Drill.....	1

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 19
**SOPHOMORE YEAR.**

Expository Composition (Eng. 2) 2	
Calculus (Math. 4).....	5
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2) 2	
Forge Work (M. E. 6).....	2
Military Drill.....	1
Elective.....	3 to 5

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 18 to 20

Calculus (Math. 4).....	5
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2) 2	
Electrical Machinery (E. E. 1)....	2
Dynamo Drawing (E. E. 2).....	2
Military Drill.....	1
Elective.....	2 to 4

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 17 to 19
**JUNIOR YEAR.**

Mechanics (C. E. 5).....	4
Dynamos and Motors (E. E. 3)....	3
Electricity and Mag. (Phys. 5)....	4
Electrical Diagrams (E. E. 7).....	2
Electrical Lab. (E. E. 4).....	2
Seminar (E. E. 17).....	1
Elective.....	2 or 3

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 18 or 19

Mechanics (C. E. 5).....	4
Applied Electricity (E. E. 5).....	4
Dynamo Design (E. E. 8).....	3
Strength of Materials (M. E. 14) 1	
Electrical Lab. (E. E. 6).....	2
Seminar (E. E. 17).....	1
Elective.....	2 to 4

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 17 to 19
**SENIOR YEAR.**

Economics (Econ. 3).....	2
Alternating Currents (E. E. 11) 4	
Electrical Design (E. E. 16).....	3
Contracts and Specifications (E. E. 14) .....	1
Electrical Lab. (E. E. 12).....	2
Seminar (E. E. 17).....	1
Thesis (E. E. 20).....	3
Elective.....	2 or 3

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 18 or 19

Economics (Econ. 3).....	2
Alternating Currents (E. E. 9)....	4
Electrical Design (E. E. 13).....	3
Power Plant Practice (M. E. 16) 1	
Electrical Lab. (E. E. 10).....	3
Seminar (E. E. 17).....	1
Thesis (E. E. 20).....	2
Elective.....	2 or 3

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 18 or 19

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 18 or 19

## Mechanical Engineering

The purpose of the course in mechanical engineering is to fit its graduates for successfully filling responsible positions as supervising and designing engineers. It furnishes fundamental training in the science, the art and the business of engineering, and prepares for the design, operation, superintendence and management of power plants, heating plants, refrigerating plants, lighting plants, pumping plants, and of the mechanical equipment of mines and railroads; and for the design, manufacture, installation, testing and operation of shop and laboratory machinery, steam and gas engines, and auxiliary equipment.

The course comprises four years' instruction and training by text book, lecture, laboratory and shop practice, based on mathematics, physics, chemistry, mechanics, machine design, structural design and thermodynamics. It is designed to give the student a thorough knowledge of the basic principles of his profession and such technical skill as the application of theoretical principles in every day practice in shop and laboratory will insure. The work of each department—class room, laboratory, shop and designing room—is made to supplement the work of each of the others, thus giving a balance in the technical equipment of the young engineer obtainable in no other way.



# MECHANICAL ENGINEERING.

## FRESHMAN YEAR.

First Semester.		Second Semester.	
English Composition (Eng. 1)....	2	English Composition (Eng. 1).....	2
Algebra (Math. 1).....	3	Analytical Geometry (Math. 3) 4	
Trigonometry (Mth. 2).....	2	Descriptive Geometry (M. E. 3) 5	
General Chemistry (Chem. 1)....	4	General Chemistry (Chem. 1)....	4
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
Mechanical Drawing (M. E. 1)....	3	Pattern Work (M. E. 2a).....	1
Wood Work (M. E. 2).....	2	Foundry (M. E. 4a).....	1
Foundry (M. E. 4).....	1	Military Drill.....	1
Military Drill .....	1		
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19		19	

## SOPHOMORE YEAR.

Expository Composition (Eng. 2) 2	Expository Composition (Eng. 2) 2
Calculus (Math. 4)..... 5	Calculus (Math. 4)..... 5
General Physics (Phys. 1)..... 3	General Physics (Phys. 1)..... 3
Physical Measurements (Phys. 2) 2	Physical Measurements (Phys. 2) 2
Kinematics (M. E. 5)..... 5	Electrical Machinery (E. E. 1).... 2
Forge Work (M. E. 6)..... 2	Kinematics (M. E. 8)..... 4
Military Drill .....	1
	Forge Work (M. E. 9)..... 1
	Military Drill .....
	1
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20	20

## JUNIOR YEAR.

Mechanics (C. E. 5)..... 4	Mechanics (C. E. 5)..... 4
Steam Engineering (M. E. 7).... 3	Thermodynamics (M. E. 18)..... 5
Electricity and Magnetism	Machine Design (M. E. 13)..... 6
(Phys. 5) .....	4
Hydraulics (C. E. 8)..... 3	Strength of Materials (M. E. 14) 1
Mechanical Drawing (M. E. 10) 2	Mechanical Laboratory (M. E.
Machine Work (M. E. 17)..... 2	15a) .....
Power Plant Practice (M. E. 16) 1	1
	Machine Work (M. E. 21)..... 2
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19	19

## SENIOR YEAR.

Economics (Econ. 3)..... 2	Economics (Econ. 3)..... 2
Steam Engineering (M. E. 22).... 6	Power Plant Engineering (M. E.
Steam and Gas Laboratory (M.	29) .....
E. 20).....	2
Dynamos and Motors (E. E. 3) 3	Engineering Laboratory (M. E.
Electrical Laboratory (E. E. 4) 2	28) .....
Seminar (M. E. 11)..... 1	2
Machine Work (M. E. 27)..... 2	Industrial Engineering (M. E.
Thesis .....	25) .....
1	2
	Seminar (M. E. 11)..... 1
	Elective.....1 to 3
	Thesis .....
	4
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19	18 to 20

**CIVIL ENGINEERING.****Professor Kneale.****Assistant Professor Snow.**

The equipment of this department consists of transits, solar attachments, precision levels, hand levels, engineers' wye and dumpy levels, plane tables, alidades, declinators, tachymeters, theodolite, sextant and horizon, reflectoscope and lantern, aneroids, engineers' compass, current meters, tide gage, automatic water registers, model flumes, etc., odometer, vicat needle, Gilmore needles, briequette machines and molds, weir measuring devices, specific gravity apparatus, fineness scales, polar and rolling planimeters, level and stadia rods, chains, tapes, drafting instruments, blue printing apparatus, complete photographic outfit, complete laboratory and drafting rooms well supplied with necessary equipment.

The department is quartered in eight rooms which include drafting rooms, seminar room, photographic dark room, cement laboratories, office, instrument room and lecture room.

(1) **Plane Surveying.**—The theory and practice of plane surveying, including the elementary principles, the use and adjustment of field and office instruments, the methods of field, topographic, hydrographic, mine and city surveying; barometric and spirit leveling, and the computation of earth work. Prerequisites: Mathematics up to and including trigonometry. Texts: Theory and Practice of Surveying, by Johnston; Manual of Surveying, by Pence & Ketchum. Lectures, 3; laboratory, 2. I, 5. M. T. Th., 11 to 12; M. W., 1 to 3:30.

(2) **Elementary Drawing.**—This course is designed to teach the student the use of draughting instruments in topography, projection, isometric drawing, mapping, sketching and lettering; the principles of perspective; and tracing and blue printing. Owing to the demand for topographical draughtsmen the course has been extended through the second semester for all students desiring to become especially proficient, and is elective to all students completing the first semester's work. Before beginning work the student will provide himself with one of the following sets of instruments or with a set of equal quality: K. & E. No. 896 NCP with No. 523½ pen, or Dietzgen No. 937 C with No. 508 pen.

(3) **Municipal Engineering.**—This course is designed especially to qualify the engineer along the lines of city planning and highway construction, both city and county. Method of allotting and plotting city additions, different surface materials, influence of grades, forms of gutters, culverts, curbing, etc., are carefully studied. This course is especially designed to meet the requirements of the municipal engineer. Prerequisites: C. E. (1, 2 and 4). Text: Baker's Roads and Improvements. Lectures, 3. II, 3. M. T. Th., 8 to 9.

(4) **Railroad Engineering.**—Railroad reconnoissance, preliminary and location surveys. Theory and practice in laying out railroad structures, simple and compound curves, easements and transition spirals, simple and compensated grades, switches, turnouts and crossings. The making and use of mass diagrams, profiles, field maps, cross sections, etc. Calculations

of yardage in embankments, excavations and borrow pits. Complete map of location survey for short line of railroad. Prerequisite: C. E. (1). Texts: Searle's Field Engineering, Webb's Railroad Construction. Lectures, 4; laboratory, 2. II, 6. M. T. W. Th., 11 to 12; M. W., 1 to 3:30.

(5) **Mechanics.**—Forces and equivalence of force systems, center of gravity and centroids, attraction, stress, strain, principle of equilibrium, rectilinear and curvilinear motion, translation, work and energy, impulse, impact, momentum, second moments, vectors, materials of engineering and testing machines, elastic and ultimate deformation, theory of beams, columns and shafts, apparent and combined stresses, resilience, fatigue, least work, true internal stresses, riveting and friction. Texts: Maurer's Technical Mechanics, and Merriman's Mechanics of Materials. Lectures, 4. I and II, 8. M. T. W. Th., 9 to 10.

(8) **Hydraulics.**—Theoretical hydraulics, hydraulic measurements; flow of water through orifices, over weirs, through pipes, conduits, and canals. Text: Merriman's Hydraulics. Prerequisites: Mathematics to and including calculus, physics (1) and (2). Lectures, 3. M. T. W., 11 to 12.

(9) **Irrigation Engineering.**—This course includes a study of the principles of impounding, diverting, conveying and measuring water; a study of the structures required in irrigation systems such as flumes, siphons, head gates, weirs, diversion works, and the various types of dams; a study of the problems of seepage and drainage in their relation to irrigation and reclamation, a sufficient study of steam, gasoline and wind driven pumps, and pump types, to enable the student to select the most efficient device for raising water for service in irrigation. The problems of cost are also taken up. Prerequisites: C. E. (1) and C. E. (4). Hydraulics must be taken in connection with the subject. Text: Irrigation Engineering, by Wilson. Lectures, 3. I, 3. M. T. Th., 10 to 11.

(11) **Field Practice.**—Practice in the use of engineering instruments on the more difficult problems of civil engineering. The work is designed to develop speed and accuracy. Photography is applied to making surveys and reports. Prerequisites: C. E. (1) and (4), and Chem. (1). Laboratory, 4. I, 4. M. T. W. Th., 1 to 3:30.

(12) **Seminar.**—In this course the student is required to deliver a lecture on an engineering topic; after the lecture the meeting is thrown open for general discussion. Each week a student is selected, by the professor in attendance, to preside at the meeting. The object of the course is to familiarize the student with recent engineering works, to assist in English composition and public speaking, and to point out the essential features of engineering articles. By means of the reflectoscope, which forms a part of the department's equipment, the student is enabled to give illustrated lectures. Lectures, 1. I and II, 2. F., 9 to 10.

(13) **Structural Engineering.**—Theory and practice in the analytic and graphic calculation of stresses in simple structures. The structures studied will include the principal types of railroad and highway bridges; roof trusses, steel buildings; trestles; standpipes; reinforced concrete,

etc. The laboratory periods are given to the preparation of complete working drawings and erection sheets for as many typical structures as possible. Prerequisites: C. E. (5). Text: Roofs and Bridges, part II, Merriman & Jacoby. Reference text: Theory of Modern Framed Structures, by Johnson, Bryan & Turneure. Lectures, 1. Laboratory, 4. II, 5. M. Tu. W. Th., 1 to 3:30. M., 3:30 to 4:30.

(14) **Sanitary Engineering.**—Collection, purification and distribution of water; systems of water supply and sewerage; disposal of sewage; house drainage; sanitary inspection. Text: Folwell's Sewerage, and Turneure & Russell's Water Supplies. Prerequisites: C. E. (4, 5, 6), (8 and 9). Lectures, 3. II, 3. M. T. Th. F., 10 to 11.

(15) **Concrete and Cement.**—A study of the physical properties, processes of manufacture, and chemical composition of commercial cements. Standard commercial tests and interpretation of results. A study of the uses, proportions, methods of mixing and placing of cement-mortar. Standard types of plain concrete structures. Text: Plain and Reinforced Concrete, by Taylor & Thompson. Laboratory, 2. II, 2. T. Th., 1 to 3:30.

(17) **Geodetic Surveying.**—Elements of geodesy. Base line measurements, triangulation, determination of position by differences, etc. Regular senior study of C. E. course. Text: Johnson's Theory and Practice of Surveying. Lectures, 2. I, 2. M. W., 9 to 10.

(18) **Water Power Development.**—A course in the development of water power. The design and use of the turbine, impulse and other forms of water motors. The design and construction of headraces, spillways, etc. The class will be required, whenever possible, to examine water powers, and report upon the design and method of development. Considerable time will be devoted to the description of recently installed plants as published in the engineering journals. Text: Merriman's Hydraulics. Reference: Church's Hydraulic Motors. Prerequisites: C. E. (1), (5, 8). Lectures, 3. I, 3. M. W. F., 10 to 11.

(19) **Engineering Design.**—This course is devoted to the design of engineering works, maps, etc. Laboratory, 3. I, II, 6. T. Th. F., 1 to 3:30.

(20) **Field Practice.**—This course is designed to give practice in the most advanced surveying. When the nature of the thesis is such as to require advanced surveying, or laboratory investigation, this period may at the discretion of the class officer, be used to assist in preparation of the thesis. Laboratory, 2. I, 2. T. Th., 1 to 3:30.

(21) **Foundations and Masonry.**—This course includes a study of materials and methods employed in the construction of piers, abutments, masonry dams, retaining walls and foundations; economy of construction; strength of joined materials; composition of different kinds of mortar; reinforced concrete construction. Text: Baker's Foundations and Masonry. Lectures, 3. I, 3. M. T. Th., 8 to 9.

(23) **Contracts and Specifications.**—The elementary law of contracts and its application to engineering considered, together with the correct

form of specifications and the judicial interpretation placed on the technical terms commonly used in engineering specifications. Text: Johnson's Contracts and Specifications. Elective to all engineering students after the sophomore year. Lectures, 2. II, 2. T. Th., 9 to 10.

(24) **Practical Astronomy.**—A course in astronomy designed to meet the needs of the civil engineer. A considerable portion of the time is given to day and night astronomical observations. Text: Comstock's Field Astronomy. Prerequisite: Mathematics (6). Laboratory, 2. II, 2.

(25) **Cost of Construction.**—This course is designed to acquaint the student with the cost of labor and materials used in engineering construction; to point out the necessity and methods of keeping accurate records of the cost of proposed engineering surveys, and construction work. Text: Gillette's Cost Data. Prerequisites: C. E. (1, 1a, 4, 5, 8), (13). Lectures, 2. I, 2. T. Th., 10 to 11.

(27) **Thesis.**—The student will be required before graduation to present a suitable thesis upon some engineering subject in the line of his course. A copy of the same, together with all original maps, tables, etc., typewritten, bound, and upon specified paper, will be filed with the college and become its property. The student is required to select his subject at the beginning of the senior year. 5, II.

(32) **Concrete Construction.**—Advanced concrete design, together with a study of surfaces, waterproofing, concrete and cement machinery, etc. Prerequisites: C. E. (15), and the first semester of C. E. (5). Lectures, 1; laboratory, 2. II, 3.

(33) **Sanitary Construction.**—Plumbing, trap ventilation, removal of waste, construction of water closets, drains and systems of water supply; sewage disposal; sanitary fixtures. Text: Cosgrove's Principles and Practice of Plumbing. Lectures, 2. I, 2.

(34) **Wood Construction.**—The growth, cutting, seasoning, working, and finishing of woods; structural and decorative properties; use of wood in buildings; detailing walls, roofs, floors, windows, doors, cornices, stairs, wainscoting, cabinet work, and interior finish. Text: Kidder's Building Construction, part I. Lectures, 1; laboratory, 2. II, 3.

(35) **History of Architecture.**—History of ancient, medieval, and modern architecture. Particular attention is given to the structural as well as to the artistic characteristics of the different styles. The student thus obtains a knowledge of the general design as well as the details of the world's buildings. Lectures, 4. I and II, 8.

(36) **Heating and Ventilation.**—The course is designed to give the student facility in designing and superintending the erection of heating and ventilating plants in such buildings as he may design or erect. Text: Hoffman's Heating and Ventilation. Lectures, 3. I, 3.

## ELECTRICAL ENGINEERING.

Professor Thaler.

Mr. Haines.

The electrical engineering department occupies a two story stone building and the second floor of a frame building. The electrical labora-



tory is located on the first floor. The second floors contain class rooms and drafting rooms, a photometer room, a battery room, and a high tension room.

The equipment of the electrical laboratory is very complete, with apparatus of modern type. There are two double current multipolar generators, capacity 15 K. W. These machines may be driven by the 40 H. P. engine or by the laboratory motor, and may be used as direct current dynamos, as alternators, single, two or three phase; as synchronous motors or as rotary converters.

The two machines are also used for practice in synchronizing, and furnish alternating current for the induction motors, and for the mercury arc rectifier. For direct current work the laboratory contains in addition to the two generators, one Excelsior 15 light arc dynamo, connected to eight series-arc-lamps, arranged for testing purposes; one 15 H. P. Northern Electric company motor; and one 10 H. P. Siemens and Halske motor. Each motor is provided with a friction brake and other auxiliary apparatus for complete tests of the armature and field resistance, of the magnetic distribution and leakage, and of the efficiency and regulation at different loads; one 6 K. W. Excelsior dynamo may be used as either a shunt or a compound machine, and is driven by the 10 H. P. motor and arranged for testing purposes.

For alternating current work the laboratory contains, in addition to the two generators, one mercury arc rectifier, capacity 30 amperes at 110 volts; one 2 H. P. single phase Westinghouse induction motor with phase splitter, provided with a prony friction brake for efficiency and regulation tests at different frequencies and at different voltages; one 6 H. P. three phase General Electric Co. induction motor, also provided with auxiliary apparatus for testing purposes.

A 150,000 volt testing transformer is used to test insulators for high tension transmission, and to test the insulation resistance of insulating materials.

Seven transformers, six single phase and one three phase, capacities from 1 to  $1\frac{1}{2}$  K. W., are available for testing purposes, and for practice in making transformer connections.

A General Electric Co. Oscillograph, with photometric and tracing table attachments, is provided for investigating the wave forms of alternating and oscillatory electro-motive forces and currents.

For general testing the laboratory contains one stationary lamp bank of 136 incandescent lamps, with a current capacity of 130 amperes at 110 volts; the lamps are arranged so that the current can be regulated within a small fraction of one ampere; four portable lamp banks of ten lamps each, arranged so that the lamps can be connected either in series or in parallel; one 900 Ohm iron wire resistance and five iron wire resistances for heavy currents, besides a number of rheostats, switches and current breakers.

The laboratory contains twenty-nine electrical measuring instruments, including nine voltmeters; one Whitney 150-300 volts; one Whit-



ney 15 volts; one Weston 150 volts; one Weston milli-meter; one Weston 75-150 volt A. C.; one Westinghouse 150 volt switchboard voltmeter.

There are eight portable ammeters; one 5 ampere D. C. Weston, three Whitney ammeters, capacity 10, 25 and 50 amperes, D. C., respectively; two Hoyt's A. C. ammeters, 10 and 30 amperes respectively; one G. E. ammeter with series transformer, 120 amperes A. C., and one Westinghouse, 120 amperes.

The department has four portable wattmeters; one Westinghouse, with series transformer, capacity 100 amperes at 200 volts; one Hoyt, capacity 1,500 K. W., one Weston, with multiplier, 2 amperes at 2,250 volts; one G. E. Co. wattmeter, capacity 10,000 watts.

The apparatus for calibrating instruments consists of one Leeds potentiometer with standard cell and standard resistance, one Kelvin standard watt balance, one Westinghouse precision voltmeter and one Westinghouse precision wattmeter.

One mercury vapor lamp, 15 arc lamps, series, constant potential, alternating and direct current, Tungsten, Tantalum and Nernst lamps are available for testing purposes.

In the photometer room is a Willyoung station photometer with universal rotator and bunsen screen for testing the candle power, distribution of light, and the efficiency of incandescent lamps.

The battery room contains a storage battery of 56 cells at 60 ampere hours capacity, of the following types: 10 chloride accumulators, 10 National Battery Co.'s unit accumulator, 10 Willard cells and 26 American cells. The batteries furnish current for calibrating instruments and are also available for testing purposes.

For wireless telegraphy and X-ray work there are two large induction coils, one Tesla high frequency transformer, one static machine, a complete set of wireless sending and receiving apparatus, Crookes' tubes and fluoroscope.

Before beginning work a student must provide himself with one of the following sets of drawing instruments or a set of equal quality: K. & E. No. 896 NCP with No. 523½ pen, or Dietzgen No. 937 C with No. 508 pen.

(1) **Electrical Machinery.**—Lectures on the construction, care and operation of commercial electrical machines and apparatus, including batteries, electric lights, dynamos, motors, alternators, transformers and electrical measuring instruments. Text: Introduction to Electrical Engineering, by H. H. Norris. Lectures, 2. II, 2. T. Th., 10 to 11.

(2) **Dynamo Drawing.**—Detail working drawing, tracing, and blue printing of electrical machines in the laboratory, to familiarize the student with the conventional methods of representing the different parts of dynamos and motors. Laboratory, 2. II, 2. F., 1 to 3:30; S., 8 to 10:30.

(3) **Dynamos and Motors.**—Principles of electro-magnetism, theory of dynamo electric machines, the design, construction and regulation of direct current dynamos and motors. Prerequisites: Physics (1) and cal-

culus. Textbook: Elements of Electrical Engineering, by Franklin and Esty. Lectures, 3. I, 3. M. W. F., 10 to 11.

(4) **Electrical Laboratory.**—Laboratory tests to determine armature and field resistance, magnetic leakage coefficients, characteristic curves and the efficiency and regulation of various types of direct current machines. Prerequisites: Physics (2) and (6). Textbook: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. I, 2. M. T., 1 to 3:30.

(5) **Applied Electricity.**—Methods and calculations of wiring, theory of primary cells and storage batteries, electric light and electrical book: Elements of Electrical Engineering, by Franklin & Esty. Lectures, 4. II, 4. M. T. W. Th., 10 to 11.

(6) **Electrical Laboratory.**—Tracing circuits and wiring, calibrating instruments, efficiency tests of storage batteries, and the candle power of incandescent lamps. Prerequisite: Physics (2). Textbook: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II, 2. M. T., 1 to 3:30.

(7) **Electrical Diagrams.**—Conventional methods of representing electrical wiring and appliances. Drawings and wiring diagrams of the switchboards in the laboratory and in the power house and diagrams of the wiring of the college buildings. Laboratory, 2. I, 2. T. Th., 10 to 12.

(8) **Dynamo Design.**—Problems in designing electro-magnets, dynamos and motors. Complete working drawings and specifications to accompany each design. Prerequisite: Dynamo drawing. Reference: Design of Dynamos, by S. P. Thompson. Laboratory, 3. II, 3. W. Th., 1 to 3:30; Sat., 8 to 10:30.

(9) **Alternating Currents.**—Theory of alternating currents, properties of alternating current circuits, principles of alternators, transformers, rotary converters and induction motors, methods of testing alternating current apparatus. Prerequisite: Physics (5). Textbook: Alternating Current Machines, by Sheldon, Mason & Hausmann. Lectures 4. I, 4. M. T. W. Th., 10 to 11.

(10) **Electrical Laboratory.**—Laboratory tests of single phase alternating current generators, motors and transformers, calibration of alternating current measuring instruments and meters. Prerequisite: Physics (6). Textbook: Laboratory and Factory Tests in Electrical Engineering by Sever & Townsend. Laboratory, 3. I, 3. W. Th. F., 1 to 3:30.

(11) **Alternating Currents.**—Development of the symbolic method of Steinmetz, the solution of problems in transformer design and calculation of transmission line by the use of the algebra of complex numbers and by vector diagrams. Prerequisite: Alternating currents (9). Textbook: Alternating Current Phenomena, by Steinmetz. Lectures, 4. II, 4. M. W., 10 to 11. T. Th., 11 to 12.

(12) **Electrical Laboratory.**—Laboratory tests of polyphase alternating current apparatus, including generators, motors, transformers and converters. Efficiency and regulation tests of a mercury arc rectifier, connecting transformers for transforming from three phase to two phase.

Prerequisite: Electrical Laboratory (10). Text book: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II, 2. Th. F., 1 to 3:30.

(13) **Electrical Design.**—Drawing and design of alternating current apparatus, circuits, and power plants. Open to students taking E. E. (9) and E. E. (11). Laboratory, 3. I, 3. M. T. Th., 8 to 10.

(14) **Contracts and Specifications.**—The law of contracts and its application to engineering contracts. Students are required to make specifications for estimates on proposed power plants, transmission lines or electrical apparatus. Textbook: Business Features of Engineering Practice, by A. C. Humphreys. Lectures, 1. II, 1. F., 10 to 11.

(16) **Electrical Design.**—Design and drawing of a transformer or induction motor to conform with certain specifications for efficiency, including the calculations of the weight and cost of the material. Prerequisite: E. E. (9). Laboratory, 3. II, 3. M. T. W., 8 to 10.

(17) **Seminar.**—Weekly meeting for the purpose of discussing current electrical engineering literature. Lectures, 1. I and II, 2. F., 9 to 10.

(18) **Special Design.**—Design and construction of some special electrical apparatus or machine. Elective for seniors. Laboratory, 3. I or I, 3.

(20) **Thesis.**—Before graduating each student must present a suitable thesis upon some engineering subject in line with his course. One copy of the thesis will be filed in the college library as the property of the college. The subject for the thesis must be chosen at the beginning of the senior year. 5. I and II, 5.

(21) **Elementary Drawing.**—Plain lettering, the use of instruments, geometrical problems, orthographic, isometric, and cabinet projections of simple objects. Laboratory, 3. I, 3. T. Th. S., 8 to 10.

## **MECHANICAL ENGINEERING.**

**Professor Dearborn.**

**Assistant Professor Sullivan.**

**Mr. Challender.**

**Mr. Kately.**

**Mr. Park.**

The facilities provided for the instruction and practice in the department of mechanical engineering include class rooms, drawing room and office occupying the south half of the basement of College Hall, wood shop, forge shop, iron and brass foundry, machine shop, office and reading room in the shop building, steam and material testing laboratory in the engineering laboratory, and the power plant of the college.

The drawing room is furnished with desks and drawers for one hundred and fifty-four students, and with numerous models, machine parts, and blue prints of trade machinery. The equipment includes also demonstration apparatus, blue print facilities, beam compasses, protractors, odontograph and universal drafting machine. The work in drawing and design is carried on in such a way as to bring out its relation to the

subsequent work in the shops, sound commercial practice being emphasized.

The material testing laboratory equipment includes a Riehle 100,000 pound testing machine, both automatic and autographic, with extensometer for tension and compression tests, and deflectometer for transverse tests; an Olsen torsion machine for specimens having a cross section up to one and one-fourth inches square; also micrometers, surface plate and gage with micrometer indicator for testing parallelism, calipers, scales, etc.

The equipment available for steam and gas engine tests comprises, in part, the following: A 7x7 inch vertical steam engine with eccentric adjustable; an 8x12 in. automatic cut-off Woodbury engine, with water cooled brake wheel, connected up with a 50 H. P. Dean Bros. surface condenser and arranged to run condensing or non-condensing, and with or without live or exhaust steam in the cylinder jacket; an 11x12 in. automatic cut-off Lycoming engine direct-connected to a 40 K. W. direct current generator, furnishing light and power for the college; a 12 H. P. Reeves throttling governor gasoline engine; all necessary brakes, generators and lamp banks for loading the engines; scales, meters, tanks, etc. In addition there are planimeters, separating and throttling calorimeters, thermometers, one Tabor (outside spring) indicator, one Thompson indicator, one set Crosby indicators, with electro-magnetic device for taking simultaneous cards, standard pressure gages, apparatus for testing gages and indicator springs under steam pressure and a Crosby oil pressure gage testing outfit.

A one hundred twenty-five horse-power Root water tube boiler, a one hundred twenty-seven horse-power Stirling water-tube boiler, an Advance compound traction engine, together with pumps, ejectors, feed water heaters, fans, etc., and the station heating plant, furnish extensive facilities for the investigation of problems related to power production, heating and ventilation.

The shops are equipped with standard machinery, and tools for working wood and metal. This equipment is being added to as needed, largely by manufacture in the shops by the students, under the supervision of competent foremen.

The wood shop measures 36x50 feet and is furnished with modern wood-working machinery, including a 20 inch Fay planer, a 14 inch circular pattern saw, a 36 inch band saw, a Fay universal jointer, a Fay and Egan friezer, a jig saw, foot mortiser, trimmer, a 16 inch pattern lathe, seven 10 inch lathes with turning tools for thirty-six students, and seventy-two complete sets of carpenter tools, with benches for joinery, house carpentry, pattern work and cabinet work.

The forge shop is 28x60 feet and contains nineteen down draft power forges with Sturtevant blowers, a 50-lb. power hammer, shear, grinder, and a full equipment of anvils and small tools. In the work here a graded series of exercises leads the student from simple drawing and upsetting to size, to complex forging and tool making, hardening



and tempering, all the work being done from working drawings.

The foundry, 30x48 feet, is equipped with a No. 1 Whiting cupola having a melting capacity of one ton of iron per hour, a brass furnace, core oven, crucibles, flasks and patterns. The work comprises bench and floor moulding, cupola and brass furnace practice, the product consisting of castings of machine parts, test bars, brass, bronze and other alloys for bearing metal, ornamental pieces, etc.

The machine shop measures 60x72 feet, and adjoining it are the tool room, stock room, office, lavatory and locker room. The equipment includes an 18-inch Davis and Egan, a 16-inch LeBlond and three 16-inch Flather engine lathes, a 14-inch Lodge and Shipley patent head tool room lathe, a 22-inch Flather planer, a 16-inch Davis and Egan shaper, a Gisholt tool grinder, a 28-inch Cincinnati drill, a 20-inch Prentice drill, a 14-inch sensitive drill, a 24-inch Barnes grinder, a 6-inch pipe machine, speed lathe, power hack saw, etc., and in the tool room a No. 1 Cincinnati universal milling machine, a Cincinnati universal grinder, a Yankee drill grinder, a brazing and tempering outfit, besides a complete equipment of small tools.

(1) **Mechanical Drawing.**—The use of drawing instruments and plain lettering; problems in geometric construction to teach accuracy in the use of instruments; orthographic projection; dimensions, arrangement, titles; tracing and blue-printing. Before beginning work, a student must provide himself with one of the following sets of drawing instruments or a set of equal quality: K. & E. No. 896 NCP with No. 523½ pen, or Dietzgen No. 937 C with No. 508 pen. Laboratory, 3. I, 3. F., 8 to 10; Tu. Th., 1 to 3:30.

(2) **Wood-work.**—A graded set of problems is given with instruction in the proper use and care of carpenter's tools and practice in working to dimensions from blue-prints, followed by a graded series of exercises in wood turning and pattern making. Tools required: One B. & S. caliper rule. Laboratory, 2. I. Fr. T. Th., 1 to 3:30.

(2a) **Pattern Work.**—A continuation of (2) in the construction of wood patterns for use in the foundry. Tools required: One 6-inch steel rule, 5-inch outside calipers. Laboratory, 1. II. Th. Fr., 1 to 3:30.

(3) **Descriptive Geometry.**—Projections of lines, plane surfaces and solids; intersections, tangents to curves and surfaces; problems in warped surfaces; practical applications. Text: Phillips & Miller. Lectures, 2; laboratories, 3. II, 5. T. F., 9 to 10; W., 10 to 11; Th., 8 to 10; F., 1 to 3:30.

(4) **Foundry.**—The instruction includes practice in floor and bench molding, core making, and in pouring castings of iron, brass and other alloys. Laboratory, 1. I, 1. M., 1 to 3:30.

(4a) Cupola and brass furnace practice in the manufacture of castings for machine parts, pipe fittings, test pieces, bearing metal, etc. Lectures or laboratory, 1. II, 1.

(5) **Kinematics.**—A study of the relative motions of machine parts, including rolling cylinders and cones, lobed wheels, belts, levers, cams,

linkwork, parallel and straight line motions, intermittent linkwork, wheels in train, and aggregate combinations. Text: Schwamb and Merrill, *Elements of Mechanism*. Lectures, 3; laboratory, 2. I, 5. M. W. F., 10 to 11; M. W., 1 to 3:30.

(6) **Forge Work.**—A graded set of exercises in iron forging, designed to teach the operations of drawing, upsetting, forming and welding, followed by exercises in forging, hardening and tempering tool steel. Tools required: One B. & S. caliper rule. Laboratory, 2. I. F., 1 to 3:30; Sat., 8 to 10:30.

(7) **Steam Engineering.**—A study of steam boilers, their classification and construction, their settings, furnaces and chimneys, and of the construction and use of the various accessories and appliances found in the boiler room; a careful study of combustion and furnace efficiency, and of the principles underlying the economical transfer of heat from the furnace to the water. Scale, corrosion and feed water treatment are given considerable attention. The course must be preceded or accompanied by (16). Prerequisites: Chemistry (1), and physics (1) and (2). Lectures, 3. I, 3. M. W. F., 11 to 12.

(8) **Kinematics.**—A continuation of (5) in the study of gearing; the cycloidal and involute systems, spur, bevel and screw gears, and the construction of the tooth. The analysis of valve motions and the design of valve gear by the use of the Zeuner and Bilgram diagrams. Texts: Schwamb and Merrill, and Spangler, *Valve Gears*. Lectures, 2; laboratory, 2. II, 4.

(9) **Forge Work.**—A continuation of the work in steel forging, including tempering, annealing and case-hardening. Laboratory, 1. II, 1. F., 1 to 3:30; S., 8 to 10.

(10) **Mechanical Drawing.**—The making of working detail and assembly drawings of machinery from measurements and empirical design; the construction and interpretation of graphical charts involving engineering principles and data, and the graphical solution of problems involving stresses in cranes, structural members and machine parts. Prerequisite: Kinematics (8), taken with mechanics (5). Laboratory, 2. I, 2. T. Th., 10 to 12; F., 8 to 10.

(11) **Seminar.**—Weekly meetings for the presentation and discussion of papers upon assigned topics pertaining to mechanical engineering. Lecture, 1. I and II, 2.

(13) **Machine Design.**—A study of machines with regard to material, form and strength of parts, and methods of construction. The development of rational and empirical formulae, and a study of experimental data, with application in the design of some machine tool, dynamometer, centrifugal or reciprocating pump, with a parallel course in drawing. Prerequisite: M. E. (10). Lectures, 3; laboratory, 3. II, 6.

(14) **Strength of Materials.**—The work consists of experimental determinations of the strength and various moduli of the more important of the materials of engineering. Tests are made in compression, tension, cross-bending and torsion, upon which written reports and discussions



are required, involving a discriminating comparison of results with accepted experimental data. Taken with mechanics (6). Laboratory, 1. II, 1. F., 1 to 3:30.

(15a) **Mechanical Laboratory.**—The use and testing for error of micrometers, planimeters and slide rules. The calibration of pressure gages, indicator springs, scales and tachometers, and efficiency tests of jack screws and hoists. Reference: Carpenter and Diederichs' *Experimental Engineering*. Prerequisite: Mechanics (5). Laboratory, 1. II, 1. M., 1 to 3:30.

(16) **Power Plant Practice.**—Each student spends  $2\frac{1}{2}$  hours per week as assistant in the college power plant, obtaining practical experience under a first-class engineer in handling boilers, pumps, engines, heating apparatus and electrical machinery, including dynamos, motors, and switch board. Laboratory, 1. I, 1.

(17) **Machine Work.**—Instruction and practice in chipping, filing, laying out, fitting, scraping, soldering and brazing. Tools required: One 6-inch steel rule; 5-inch outside calipers. Laboratory, 2. I, 2. T. Th., 1 to 3:30.

(18) **Thermodynamics.**—A study of the principles of thermodynamics; a discussion of the properties of gases, saturated and superheated vapors, especially of air and steam; and a study of the various cycles of steam engines, hot air engines and internal combustion engines from the physical, analytical and graphical point of view. Text: Goodenough, *Principles of Thermodynamics*; Peabody, *Thermodynamics of the Steam Engine*; and Berry, *Temperature-Entropy Diagram*. Prerequisite: M. E. (7, 8, 16). Lectures, 5. II, 5. M. T. W. Th. F., 10 to 11.

(20) **Steam and Gas Laboratory.**—Steam and gas engine indicator practice, valve setting by measurement and by the card, calorimetric determination of the quality of steam, tests of pumps, injectors, and engines. Prerequisite: Thermodynamics (18). Laboratory, 2. I.

(21) **Machine Work.**—Practice with instruction in drilling, boring, turning, thread and gear cutting. Prerequisite: (12). Tools required: Six-inch steel rule, 5-inch outside and inside calipers, center gage. Laboratory, 2. II, 2.

(22) **Steam Engineering.**—The application of the principles of thermodynamics in the study of the compound engine, Hirn's analysis, economy of engines, compressed air, the flow of fluids through orifices, nozzles and pipes, the steam injector, the steam turbine in detail, refrigerating and heating systems, air, steam and hydraulic pumps. The work in design will cover the details of one or more pieces of apparatus studied in class. Text: Peabody, Kent. Reference: Thomas. Prerequisite: Thermodynamics (18). Lectures, 4; laboratory, 2. I, 6.

(25) **Industrial Engineering.**—The organization and management of manufacturing establishments; cost accounting, distribution of expenses; systems of compensating labor; contracts and specifications. Lectures, 2. II, 2.

(27) **Machine Work.**—Advanced work on lathe, milling machine,

and grinder. The manufacture of reamers, drills, taps, mills, and dies. The heat treatment of high speed steel. Laboratory, 2. I, 2.

(28) **Engineering Laboratory.**—A continuation of (20), including efficiency tests of heating, ventilating, and power plant equipment. Laboratory, 2. II, 2.

(29) **Power Plant Engineering.**—The study and design of a modern steam power plant. The work includes the design of the structural features of the building or buildings of the plant, together with the selection, from standard types, of such apparatus as will be best suited to the requirements laid down, and the assembling of these engines, boilers, fans, and auxiliaries in such a way as will give the highest possible operating economy. Prerequisite: M. E. (14), (18) and (22). Lectures, 4; laboratory, 2. II, 6.

**Thesis.**—Before graduating, the student is required to present an acceptable thesis involving an investigation of some problem related to mechanical engineering, which will become the property of the college. The work will be done under the supervision of the head of the department but the student will devise his own methods. The subject must be selected by November fifteenth of the senior year. I and II, 5.

## Division of Science

The college offers six separate courses leading to the degree of bachelor of science, which are tabulated on the following pages. It will be noted that in these tabulations there is but little change in the actual requirements from the work offered during the past years. In the earlier years of the course, much of the foundation work in science, language and mathematics is common to all the courses.

The names given to these courses are generally indicative of their nature—biology, chemistry, home science, history-literature, mathematics-physic and secretarial.

Candidates for the bachelor's degree in science must complete satisfactorily not less than 130 credits, including the prescribed work in military drill or physical training; and including also a thesis, the value of which in credits shall be determined by the instructor concerned. No regular student may take in any one semester work amounting to more than nineteen credits or less than twelve.

Students who are relieved for any reason of the requirements in military drill or physical training, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

Several subjects taught in departments not represented in this division are open to election by students in science on consent of their advisers. Among these may be mentioned music, (limited to four credits for any one person) and such subjects in the divisions of agriculture or engineering as the applicant may be qualified for, and as the schedule permits.

A more detailed statement of the direct purpose of each of these courses may be found just preceding the tabulation of each course.

## Biology

Through the electives allowed in the biology course, the student may select lines of work leading toward the following professions: general zoology; economic zoology; economic entomology; general botany; plant pathology and bacteriology.

The course also furnishes an excellent preliminary training for the professions of medicine, veterinary science, forestry and teaching.

In the government service, both in the Department of Agriculture at Washington and in the various experiment stations, there are many desirable openings both for young men and young women. In plant pathology, bacteriology, entomology and economic zoology, there is a growing demand for suitably qualified workers. Women are more and more in demand as scientific clerks and assistants.

The passage of the Adams Act, whereby the federal appropriation to the experiment stations in the various states is materially increased, is creating a greater demand for workers in biological as in other lines and as never before, the outlook in these lines is inviting.

Students in the biology course are allowed considerable latitude in choosing their electives, but it is intended that they shall be guided by their class officer in selecting the sub-courses that contribute most directly to their chosen line of work.

**BIOLOGY.****FRESHMAN YEAR.**

## First Semester.

English Composition (Eng. 1)....	2
Public Speaking (Eng. 4).....	1
Trig and Log. (Math. 2a).....	3
Gen. Chemistry (Chem. 1).....	4
Gen. Botany (Biol. 9).....	5
*Mech. Draw. (M. E. 1).....	2
Drill or Gymnasium.....	1
<hr/>	
	18

## Second Semester.

English Composition (Eng. 1)....	2
Public Speaking (Eng. 4).....	1
*Prin. of Plant Culture (Hort. 1)	3
General Chemistry (Chem. 1)....	4
Plant Phys. (Biol. 10).....	4
Drawing from Nature (Art. 4)....	2
Drill or Gymnasium.....	1
<hr/>	
	17

**SOPHOMORE YEAR.**

Expository Composition (Eng. 2)	2
Qualitative Analysis (Chem. 2)..	4
Gen. Des. Physics (Phys. 1a).....	3
Invertebrate Zool. (Biol. 1).....	4
*Field Crops (Agron. 1).....	5
Drill or Gymnasium.....	1
<hr/>	
	19

Expository Composition (Eng. 2)	2
Organic Chemistry (Chem. 5)....	5
Gen. Des. Physics (Phys. 1a).....	3
An. Phys. and Anat. (Biol. 3)....	5
Geology (Geol. 1).....	3
Drill or Gymnasium.....	1
<hr/>	
	19

**JUNIOR YEAR.**

Advanced Composition (Eng. 3)	
or Literature (Eng. 10).....	2
Bacteriology (Biol. 12).....	5
General Entomology (Biol. 4)....	4
Elective.....	7 or 8
<hr/>	

Advanced Composition (Eng. 3)	
or Literature (Eng. 10).....	2
Plant Pathology (Biol. 11) or	
Vertebrate Zoology (Biol. 2)..	4
Organic Evolution (Biol. 14)....	2
*Farm Mechanics (Agron. 4)....	3
Elective.....	7 or 8
<hr/>	

18 or 19

18 or 19

**SENIOR YEAR.**

Economics (Econ. 3).....	2
Psychology (Phil. 1).....	3
Thesis .....	5
Elective.....	7 or 8
<hr/>	

Economics (Econ. 3).....	2
Ethics (Phil. 2).....	3
Thesis .....	5
Elective.....	7 or 8
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17 or 18

17 or 18

\*Women may elect other subjects.

## Chemistry

The principles of chemistry, together with some of the applications of the science, are taught to the freshmen in all courses offered by the college. In addition to this elementary instruction some departments require sufficient training in chemistry to enable the student to apply the principles of the science to some special phase of the general course he is pursuing. This is true in the college courses in agriculture, domestic science, pharmacy and sanitary engineering. Further, students who wish to follow chemistry as a profession are advised to take systematic training in the science during the four years of undergraduate study.

The outline of studies offered in the chemical course is designed to meet the needs of the last named class of students. The sub-courses listed in the freshman and sophomore years leave no room for electives and are required of all students registering in the chemistry course. These courses are all fundamental and are prerequisite to both the required and elective work offered in the last two years of the course.

Electives are offered in the junior and senior years in order that other subjects may be combined with chemistry with the idea of shaping the training toward some special field of the science. By a proper selection of electives it is possible to prepare for the following more or less distinct branches of the science, engineering chemistry, agricultural chemistry, biochemistry, and general chemistry. The electives will be assigned on consultation with the class officer as follows:

**Engineering Chemistry.**—Electives may be taken from the sub-courses in civil, mechanical and electrical engineering, physics, mathematics, chemistry and language.

**Agricultural Chemistry.**—Electives are to be selected from the sub-courses in biology, agriculture, chemistry and language.

**Biochemistry.**—Electives must be selected from the sub-courses in biology mainly, together with language, physics and chemistry.

**General Chemistry.**—Students who wish to specialize in pure chemistry may take electives in chemistry, physics, mathematics and language.

The engineering option offers a combination of studies which approaches what is usually known as a course in chemical engineering. It prepares for positions in chemical laboratories connected with manufacturing industries and for conducting operations requiring a working knowledge of both chemistry and engineering.

The agricultural and biochemistry options give an excellent foundation for the study of almost any phase of agricultural science. They especially prepare for positions in experiment station laboratories and in government and state food laboratories.



## CHEMISTRY.

## FRESHMAN YEAR.

First Semester.		Second Semester.	
English Composition (Eng. 1)....	2	English Composition (Eng. 1)....	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
Algebra (Math. 1).....	3	Analytical Geometry and Calculus (Math. 3).....	4
Trigonometry (Math. 2).....	2	German or French.....	4
German or French.....	4	General Chemistry (Chem. 1)....	6
General Chemistry (Chem. 1)....	4	Drill .....	1
Mechanical Drawing (M. E. 1) 2			
Drill .....	1		
	—		—
	19		18

## SOPHOMORE YEAR.

Qualitative Analysis (Chem. 2)..	5	Organic Chemistry (Chem. 5).....	5
Anal. Geom. and Calculus (Math. 4) .....	5	Anal. Geom. and Calculus (Math. 4) .....	5
General Physics (Phys. 1a).....	4	General Physics (Phys. 1a).....	4
German or French.....	3 or 4	German or French.....	3 or 4
Drill .....	1	Drill .....	1
	—		—
	18 or 19		18 or 19

## JUNIOR YEAR.

Economics (Econ. 3).....	2	Economics (Econ. 3).....	2
Mineralogy (Chem. 12).....	3	Geology (Geol. 1).....	3
Advanced Inorganic Chem. (Chem. 6) .....	3	Advanced Inorganic Chem. (Chem. 6) .....	3
Quantitative Analysis (Chem. 3) 4		Quantitative Analysis (Chem. 3) 4	
Elective .....	5 to 7	Elective.....	5 to 7
	—		—
	17 or 19		17 or 19

## SENIOR YEAR.

Organic Analysis (Chem. 4).....	4	Industrial Chemistry (Chem. 9) 4	
Thesis (Chem. 16).....	2	Thesis (Chem. 16).....	2
Elective.....	10 to 12	Elective.....	10 to 12
	—		—
	16 or 18		16 or 18

## History and Literature

In accordance with the general plan of the division of science, this course leads to the degree of bachelor of science. It includes properly, therefore, strong courses in at least two of the three sciences, physics, chemistry and biology, though it does not contemplate advanced work in any of these subjects. Throughout the course a large amount of time is devoted to the study of foreign language and during the later years of the course a good deal of time is given to history and literature. It is not expected that the graduate in this course will be technically equipped in any of these subjects, though by the systematic arrangement of his electives he may emphasize such lines of the work as he is especially attracted to. Graduates should therefore be fitted to teach in the high schools, history, English, and one or more of the foreign languages.

The prime purpose of the course, however, is to offer to those who can afford it a good general education, the purpose of which shall be a wide acquaintance and sympathy with the most important ideas and activities of civilization. Such an education, it is believed, is well worth having for its own sake; and for those who can afford the time, it is a valuable preparation for the specialization of the graduate school, or of the professional or technical school.

## HISTORY-LITERATURE.

### FRESHMAN YEAR.

First Semester.		Second Semester.	
English Comp. (Eng. 1).....	2	English Composition (Eng. 1)....	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
Algebra (Math. 1).....	3	Anal. Geometry (Math. 3).....	4
Trigonometry (Math. 2).....	2	Foreign Language (Fr., Gr. or	
Foreign Language (Fr., Ger.,		Latin) .....	4
or Latin) .....	4	General Chemistry (Chem. 1)....	4
General Chemistry (Chem. 1)....	4	Art .....	2
Military Drill or Physical Train-		Military Drill or Physical Train-	
ing .....	1	ing .....	1
—	—	—	—
	17		17

### SOPHOMORE YEAR.

English Composition (Eng. 2)....	2	English Composition (Eng. 2)....	2
English Literature (Eng. 10)....	2	English Literature (Eng. 10)....	2
Foreign Language.....	6 or 8	Foreign Language.....	6 or 8
European History (Hist. 1).....	3	European History (Hist. 1).....	3
Military Drill or Physical Train-		Military Drill or Physical Train-	
ing .....	1	ing .....	1
*Elective .....	2-5	*Elective .....	2-5
—	—	—	—
	16-19		16-19

### JUNIOR YEAR.

**Economics (Econ. 3).....	2	**Economics (Econ. 3).....	2
Foreign Language .....	2-4	Foreign Language .....	2-4
English Literature or Composi-		English Literature or Composi-	
tion (English 3, 11 or 13) or		tion (English 3, 11, 12 or 13	
History (2or 5).....	2-3	or (History 2 or 5).....	2-4
*Elective .....	6-13	*Elective .....	5-13
—	—	—	—
	15-19		15-19

### SENIOR YEAR.

Psychology (Psych. 3).....	3	Ethics (Ethics 2).....	3
Sociology (Philosophy 4).....	3	Thesis .....	6
*Elective .....	9-13	*Elective .....	6-10
At least 4 credits must be taken		At least 4 credits must be taken	
in either History, English or		in either History, English or	
Foreign Language.		Foreign Language.	
—	—	—	—
	15-19		15-19

\*All candidates for a degree in this course must take a year of work either in physics or biology. All young women are also advised to take one course in cooking and one in sewing.

\*\*The order in which the required subjects are to be taken up in the junior and senior years may be varied upon the consent of the class officer and the instructor concerned.

## Home Science

The object of this course is two-fold: First, to give young women a liberal education with a scientific basis, and to train them along lines pertaining to the science, management and care of the home. Second, to give training to those who wish to become teachers of home science. This course gives an opportunity for the combination of biology, chemistry and art with home science.

In the junior and senior years there is considerable opportunity for electives, but electives must be chosen by the advice and with the approval of the class officer. History, German, French, art, music and English may be elected in the junior year. History, chemistry, biology, art, music, English, physics and sociology, may be elected in the senior year. Senior students should take either English, modern language or sociology.

### HOME SCIENCE. FRESHMAN YEAR.

First Semester.		Second Semester.	
English Comp. (Eng. 1).....	2	Public Speaking (Eng. 4).....	1
Public Speaking (Eng. 4).....	1	English Comp. (Eng. 1).....	2
German or French.....	4	German or French.....	4
Trig. and Log. (Math. 2a).....	3	Prin. of Cookery (H. S. 1).....	4
General Chemistry (Chem. 1)....	4	General Chemistry (Chem. 1)....	4
Sewing (H. S. 11).....	3	Art (Art 1).....	2
Physical Training .....	1	Physical Training .....	1

18

### SOPHOMORE YEAR.

Expository Comp. (Eng. 2).....	2	Expository Comp. (Eng. 2).....	2
German or French.....	4	German or French.....	4
Food Chemistry (Chem. 8).....	5	Food Studies (H. S. 2).....	4
Invertebrate Zoology (Biol. 1)....	4	Animal Physiology (Biol. 3).....	5
Dressmaking (H. S. 12).....	2	Household Architecture (H. S.	
Art .....	1	3) .....	3
Physical Training .....	1	Physical Training .....	1

19

19

### JUNIOR YEAR.

Economics (Econ. 3).....	2	Economics (Econ. 3).....	2
Bacteriology (Biol. 12).....	5	Invalid Cookery (H. S. 3).....	2
Textiles (H. S. 13).....	2	Dressmaking (H. S. 14).....	3
Advanced Cookery (H. S. 4).....	2	Costume Design (Art).....	2
Dietetics (H. S. 6).....	2	Household Management (H. S. 7) <b>3</b>	
History (Hist. 1) or Qualitative		History (Hist. 1) or Animal Nu-	
Analysis (Chem. 3).....	4	trition (Chem. 11).....	3
Electives .....	0 to 3	Elective.....	0 to 4

16-19

15 to 19

### SENIOR YEAR.

Home Problems (H. S. 9).....	2	Ethics (Phil. 2).....	3
Psychology (Phil. 1).....	3	Teaching of Domestic Science	
Seminar (H. S. 10).....	2	H. S. 8).....	3
Teaching of Domestic Art.....	2	Embroidery (H. S. 16).....	2
Thesis .....	2 to 4	Art .....	2
Elective.....	2 to 8	Thesis .....	2 to 4
		Elective.....	3 to 7

15 to 19

15 to 19

## Mathematics and Physics

This course as outlined on the opposite page is designed to fill the needs of two or three classes of students. The required work is such as to give an excellent preparation for students desiring to become teachers in these subjects, and by proper choice of the electives a broad education in other subjects may be obtained. Prospective teachers are advised to arrange their electives so that they will be qualified to teach other subjects, such as biology, chemistry, English or foreign language, as often they are required to teach such subjects in combination with mathematics or physics.

There is an increasing demand for men who have a more extended and exact knowledge of the fundamental sciences than can be obtained from the ordinary technical course. This comes from a class of employers who desire men so equipped and prefer to give them the practical training they need. This course is designed to give the theoretical training. If the student should take this course, planning to take an engineering course later, he can choose his electives so that any of the engineering courses may be completed in two years after graduation from the mathematics-physics course. In this case the following subjects are suggested from which it is desirable to elect: Freehand drawing, mechanical drawing, chemistry, mechanics, applied electricity, dynamos and motors, hydraulics, sanitary engineering. The particular electives of this course will be chosen in accordance with the direct aim of the student. In addition, the above course lays a foundation for the work of the graduate school.



**MATHEMATICS—PHYSICS.****FRESHMAN YEAR.**

First Semester.		Second Semester.	
English Composition (Eng. 1)....	2	English Composition (Eng. 1)....	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
Algebra (Math. 1).....	3	Anal. Geometry and Calculus	
Trigonometry (Math. 2).....	2	(Math. 3).....	4
German or French.....	4	German or French.....	4
General Chemistry (Chem. 1).....	4	General Chemistry (Chem. 1).....	4
Military Drill or Physical Train-		Military Drill or Physical Train-	
ing .....	1	ing .....	1
	—		—
	17		16

**SOPHOMORE YEAR.**

Expository Composition (Eng. 2)		Expository Composition (Eng. 2)	
or English Literature (Eng.		or English Literature (Eng.	
10) .....	2	10) .....	2
Analytical Geometry and Calculus		Analytical Geometry and Calculus	
(Math. 4).....	5	(Math. 4).....	5
General Physics (Phys. 1).....	3	General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2)	2	Physical Measurements (Phys. 2)	2
German or French.....	3 or 4	German or French.....	3 or 4
Elective.....	0 to 4	Elective.....	0 to 4
Drill or Physical Training.....	1	Drill or Physical Training.....	1
	—		—
	16-19		16-19

**JUNIOR YEAR.**

Differential Equations (Math. 10)	3	Geology (Geol. 1).....	3
Electricity and Magnetism		Differential Equations (Math. 10)	3
(Phys. 5) .....	4	Light and Sound (Phys. 3).....	2
or Least Squares (Math. 5)....	2	Physical Measurements (Phys. 4)	2
Economics (Phil. 3).....	2	Economics (Phil. 3).....	2
Elective.....	6 to 10	Elective.....	6 to 8
	—		—
	15-19		15-19

**SENIOR YEAR.**

Theoretical Astronomy (Math.		Theoretical Astronomy (Math. 6)	3
6) .....	3	Two Courses from Advanced	
Two Courses from Advanced		Physics (Phys. 6).....	3
Physics (Phys. 6).....	3	and Mathematics (11, 12, 13 or	
and Mathematics (11, 12, 13 or		14).....	2 or 3
14).....	2 or 3	Elective and Thesis.....	7 to 11
Elective and Thesis.....	7 to 11		—
	—		—
	15-19		15-19

## Secretarial Course

This is a college course requiring fifteen units of preparation for admission, and extending through four years of study. The degree of Bachelor of Science will be conferred upon completion of the course. There is a demand for young men and women with more advanced training than the commercial high school and the business college give. The Secretarial Course is intended to prepare for such positions as private secretary to public and corporation officials, expert office assistant, the government civil service, institutional manager, association secretary, etc.

The course consists of thorough training in such foundation subjects as English and modern foreign language, together with some science, mathematics, history and economics. The special technical work includes advanced courses in shorthand, typewriting, business correspondence, office practice and methods, business organization and administration, commercial law, editing and preparing copy for press, etc.

Only the freshman and sophomore years are tabulated at this time. Next year the entire secretarial course will be offered.

## FRESHMAN YEAR.

## First Semester.

English Composition (Eng. 1)....	2
Public Speaking (Eng. 4).....	1
German, French or Spanish.....	4
Trigonometry (Math. 2a).....	3
Shorthand (Sec. 1).....	4
Typewriting (Sec. 3).....	4
Drill or Physical Training.....	1
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## Second Semester.

English Composition (Eng. 1).....	2
Public Speaking (Eng. 4).....	1
German, French or Spanish.....	4
Business Correspondence (Sec. 5)	3
Shorthand (Sec. 1).....	4
Typewriting (Sec. 3).....	4
Drill or Physical Training.....	1
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	19

## SOPHOMORE YEAR.

Expository Composition (Eng. 2)	2
German, French or Spanish.....	4
History (Hist. 1 or 5).....	3
Office Practice (Sec. 6).....	2
Shorthand (Sec. 2).....	3
Typewriting (Sec. 4).....	3
Drill or Physical Training.....	1
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	18

Expository Composition (Eng. 2)	2
German, French or Spanish.....	4
History (Hist. 1 or 5).....	3
Office Practice (Sec. 6).....	2
Shorthand (Sec. 2).....	3
Typewriting (Sec. 4).....	3
Drill or Physical Training.....	1
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**ART.****Miss Lana A. Baldwin.****Miss Genevieve Lane.**

The art department occupies the entire north front of the second floor in College Hall. The studios are large and well lighted.

The department has a very complete and carefully selected collection of casts from the antique, including full length casts of the Venus de Milo, Borghese Warrior, and the Winged Victory.

The equipment for work in the handicrafts includes work benches and full sets of tools for each individual student electing work in metalry and jewelry, potter's wheels for throwing and casting pottery and a china kiln of the largest size for firing china.

There is a fine collection of works on art in the library suitable for class reading and serious study, also photographs from foreign countries and reproductions of celebrated pictures.

1—**Drawing** from the cast in charcoal, pencil crayon or pen and ink. Also still life and object drawing. I and II, 4, 6. T. Th., 9 to 11.

2—**Painting** in water color and oil.

(a)—**Work from nature and still life.** Prerequisite: Art (1). I and II, 6.

(b)—**Illuminating** on vellum or parchment. Prerequisite: Art (1) and art (7). I and II, 2-4.

3—**Architectural Drafting.**—Study of architectural shades and shadows, also conventional rendering in wash and color. Freehand perspective sketching from mechanical drawings. Sketching from nature when weather permits, in pencil and water color. I, 3.

4—**Drawing from Nature.**—In pencil, pen and ink, wash and color. This is intended especially for students in biology. II, 2. T. Th., 10 to 12.

5—**Clay Modeling.**—Decorative work from original designs, given in connection with study of historic ornament and design. I or II, 2.

6—**History of Art.**—This work is intended especially for students in design. Particular attention is given to the study of historic ornament and the classic styles as exemplified in painting, sculpture and architecture. I and II, 4.

7—**Design.**—Study of applied design and incidentally the use of water colors. Students submit original designs. I and II, 4.

8—**Costume Design.**—The study of color and design as applied to dress. History of costume. This course is made as practical and helpful as possible. Students prepare original designs which are executed in the sewing classes. II, 2.

8a—**Embroidery Design.**—Students study theory of color and design and submit original designs for embroidery. Work rendered in black and white and in color. II, 2.

8b—**Household Decoration.**—Study of color, line and form as applied to house furnishings. Students are given practical problems to demonstrate these theories. I and II, 2-4.

9—**Design.**—Study of applied design for the decoration of china.

This includes study of color. I and II, 4.

10—**Painting on China**.—Students to be admitted to the classes in china painting must satisfy the instructor that they have the necessary preparation to undertake the work profitably. China is fired in the studio. Prerequisite: (1), (2), (9). I and II, 4-8.

11—**Leather**.—Tooling, modeling and embossing; also use of dyes and stains for leather. Prerequisite: (7). I and II, 4.

12—**Jewelry**.—Making of simple and unique jewelry in silver and in copper. This includes saw-piercing, enameling, repousse and the setting of semi-precious stones. Prerequisite: Course (7). I and II, 4-6.

13—**Metal**.—Work in copper, brass and silver. This course includes raising, saw-piercing, etching, hard and soft soldering and riveting. Prerequisites: Art (7). I or II, 4-6.

### BIOLOGY.

Professor Cooley.

Professor Swingle.

Assisant Professor Spaulding.

Mr. Jennison.

The biology department now occupies the whole of the building formerly used also by the Experiment Station and the agricultural departments. The building has been remodeled and made more suitable for biological work.

In the basement is a lecture room with seating capacity for fifty students, equipped with a lantern and a large stock of lantern slides and wall charts, illustrating various courses in biology. On the east side of the basement is the herbarium room containing a large and valuable collection of Montana plants and many from other parts of the world. The south side of the same floor is divided into a station laboratory and a large storeroom.

The entire west half of the first floor serves as a laboratory for the larger classes, and is equipped with the necessary furniture and compound and dissecting microscopes. The east half of the first floor is occupied by the office of the department, the department library and a private laboratory for the station entomologists. This laboratory contains a large representative collection of Montana and exotic insects, which is being constantly added to.

The second floor is given over to laboratories and the office and laboratory of the station botanist. The west laboratory is used by the smaller classes in zoology and physiology and contains dissections of the various animals studied, as well as a portion of the general zoological collection.

The east laboratories are fitted for bacteriological work with special student lockers, incubators, steam and dry air sterilizers and culture rooms.

The third floor is occupied by a zoological lecture room, with wall cases containing different animals and dissections for illustrating lec-

tures; a small museum room and a private laboratory.

Two greenhouses on the south side of the building are used for class and station work in plant physiology and pathology. These are equipped with the necessary plants and apparatus for experimental plant physiology. Opening out of the main greenhouse laboratory are an insectary for the rearing of insects and a dark room for photographic work and for conducting experiments in plant physiology.

The department library contains a valuable set of the most important books and periodicals upon biological subjects. Large collections of specimens and mounts in the various branches of biology are being constantly added to, making important adjuncts to the class and laboratory work in these subjects.

(1) **Invertebrate Zoology.**—Devoted to the study of the invertebrate animals, including their morphology, development, habits, economic or popular interest, and classification. The broad biological principles are brought out and emphasized. The class room work is based on Hegner's "Introduction to Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of animals. Required of agricultural, home science and biology students. Lectures, 2; laboratory, 2. I, 4. Assistant Professor Spaulding. M. W., 8 to 9; W. F., 1 to 3.

(2) **Vertebrate Zoology.**—A continuation of (1), taking up vertebrate (chordate) forms. Required of animal industry and biology students. Prerequisite: Biol. (1). Lectures, 1; laboratory, 3. II, 4. Assistant Professor Spaulding. Hours to be arranged.

(3) **Animal Physiology and Anatomy.**—By means of lectures and demonstrations the main principles of animal physiology are presented to the students, while in the laboratory they become familiar with the most important features of mammalian anatomy. Required of agricultural, home science, pharmacy, and biology students. Prerequisite: Biol. (1). Lectures, 3; laboratory, 2. II, 5. Assistant Professor Spaulding. Th., 8 to 9; M. W., 9 to 10; W. F., 1 to 3.

(4) **General Entomology.**—Lectures on the morphology, metamorphoses and classification of insects and a study of the various orders. Collecting, naming, labeling and arranging in museum form species that are to be found in the vicinity of Bozeman. Required of biology and agricultural students. Elective for others who have taken (1). Lectures, 2; laboratory, 2. I, 4. Professor Cooley. M. W., 9 to 10; T. Th., 1 to 3.

(5) **Advanced Entomology.**—This course is a continuation of the general entomology course (4), and is made up of lecture, reading and conference work and of laboratory exercises. Students in this course will be assigned laboratory work best suited to their special requirements. Lectures, 2; laboratory, 2. II, 4. Professor Cooley. M. W., 9 to 10; T. Th., 1 to 3.

(6) **Economic Entomology.**—Principles underlying insect depredations



and their control; insecticides and insecticide machinery; notable insect pests of our time and of earlier times; entomological journals and early literature; prominent workers of today and earlier times. Lectures, 3; laboratory, 1. II, 4. Professor Cooley. Hours to be arranged.

(9) **General Botany.**—Morphology, anatomy and elementary physiology of plants, including life history studies of all the groups. The fundamental biological principles are here laid down on which all higher botanical studies are based. Required of all biology and agriculture quistestudents. Lectures, 2; laboratory, 3. I, 5. Professor Swingle and Mr. Jennison. T. Th., 9 to 10; M. T. Th., 1 to 3.

(10) **Plant Physiology and Histology.**—Experimental work in the movement, growth, nutrition and reproduction of plants with a microscopical study of the structures involved. Prerequisite: Biology (9) and first semester of chemistry (1). Required of agricultural and biology students. Lectures, 1; laboratory, 3. II, 4. Professor Swingle and Mr. Jennison. M., 1 to 3; T., 9 to 11; Th., 8 to 10; F., 10 to 11.

(11) **Plant Pathology.**—General facts and principles governing the health and disease of plants, with illustrative experiments, followed by a study of the classification, morphology, and special physiology of parasitic plants, with especial reference to diseases of cultivated crops in Montana. Prerequisite: Biology (9) and (12). Required of agronomy and horticultural students. Lectures, 1; laboratory, 3. II, 4. Mr. Jennison. T., 10 to 11; T. W. Th., 1 to 3.

(12) **Bacteriology.**—A study of the structure, life history and classification of bacteria, their growth in nutrient media, and methods of bacteriological technique. The relation of bacteria to agriculture, disease, and our daily life is discussed. Prerequisite: Biology (9) or (3) and chemistry (1). Required of agriculture and home science students. Lectures, 2; laboratory, 3. I, 5. Professor Swingle and Mr. Jennison. T. Th., 10 to 11; F., 1 to 3; T. Th., 8 to 10.

(13) **Embryology.**—An introductory course in embryology, embracing a study of the foundation and growth of tissues in the vertebrate body, based chiefly on a study of the chick, but including consideration of the development in the mammalia. Open to students who have completed biology (2) or (3). Lecture, 1; laboratory, 3. I, 4. Assistant Professor Spaulding. Hours to be arranged.

(14) **Organic Evolution.**—A lecture course treating of the different evolution theories and their present status; will also include such topics as the origin of species, heredity, variation, natural and artificial selection, adaptations, etc. Lectures and assigned reading. Required of agriculture and biology students and elective to students who have completed at least two courses in biology. Lectures, 2. II, 2. Assistant Professor Spaulding. T. Th., 11 to 12.

(15) **Thesis.**—Students in the biology course in their senior year and seniors from other courses, who have had sufficient previous training in biology, may devote a maximum of five credits per semester to thesis

work, under the direction of Professors Cooley or Swingle, or Assistant Professor Spaulding.

### **CHEMISTRY.**

**Prof. Cobleigh.**

**Mr. Barnes.**

**Mr. Weatherhead.**

**Mr. Gottschalck.**

The applications of chemistry to the various phases of agriculture, to engineering and to many modern industries, make this science an important one in a technical school. The fundamental courses of the science should be thoroughly taught in order that the student may have sufficient training and independence to apply his knowledge to practical operations. If the student is to master the principles of chemistry and at the same time obtain a working and practical knowledge of chemical manipulation, he must have certain facilities at his disposal.

Below is given somewhat in detail, a description of the equipment and the conveniences provided for the study of chemistry in this institution:

The lecture room, with raised floor and seating capacity for one hundred and fifty students, has a lecture desk provided with water, gas, and electricity, a demonstration balance and stereopticon for showing the applications of the science. The class room exercises in general and applied chemistry are illustrated by experiments, lantern slides, and in many cases by exhibits of the raw materials and finished products of commercial processes. The lecture room equipment is in an adjoining room, which also serves as a private laboratory.

There are five laboratories equipped for the following lines of work: General chemistry, qualitative and quantitative analysis, organic and food chemistry, physical chemistry, and assaying. All desks are provided with water, gas, electricity, and filter pumps where needed. The hoods in each laboratory are furnished with gas and water and connections from a large Parson's hydrogen sulphide generator which will supply forty jets at one time. In each hood there are large steam and air baths in operation at all times, being connected to the steam heating plant. The building is well ventilated by means of a mechanical draft, and heated by a direct-indirect steam system. With some of the classes working in sections the laboratories will accommodate 150 students.

The store room is stocked with an ample supply of the apparatus and chemicals needed for the various laboratory courses. The student secures what equipment he needs from time to time, in addition to that always kept in his desk, from the store keeper, who is on duty at convenient and stated hours. The equipment includes, besides the usual stock of apparatus, much that is designed for special use, such as accurate balances for both quantitative analysis and assaying, standard weights, equipment for calibrating measuring apparatus, polariscopes, Abbe refractometer, oil testers, apparatus for water, air, and gas analysis, combustion furnaces, Hoskin's crucible and muffle furnaces for assaying and for experiments

necessitating high temperatures, apparatus for gas density determinations, Beckman's freezing and boiling point apparatus, and equipment for conductivity measurements, etc.

The department museum occupies a well lighted room in the basement. In this room are stored in cabinets, and glass exhibit cases, the collections illustrating chemical industries of various kinds, and the mineralogical and geological specimens. The mineral collection is quite extensive. It includes a valuable private collection purchased by the college some years ago. To this was added a part of the Montana mineral exhibit at Chicago in 1893, and large additions have been made from time to time through exchanges and purchases. The collection is thoroughly representative and forms an important adjunct to the chemical department.

The chemical library and office is located on the first floor and contains full sets of the *American Journal of Science*, *Journal of the American Chemical Society*, *Journal of the (London) Chemical Society*, *Berzelius Jahresbericht*, *Bericht der deutschen Chemischen Gesellschaft*, and *Fresenius Zeitschrift fur Analytische Chemie*. There are also partial sets of *Chemical News*, and the *Analyst*. Besides these the library contains many standard reference works and the recent text books. There are also index volumes and card catalogues to facilitate more ready reference to the literature.

(1) **General Chemistry.**—Two lectures, one recitation and one 2½-hour laboratory period per week throughout the year on the fundamental laws of chemistry, the history, occurrence, preparation and properties of the common elements and their compounds. Text books: *General Chemistry*, by Kahlenberg, and laboratory notes prepared by instructors in the department. Lectures, 2; quizzes, 1; laboratory, 1. I and II, 8. Lectures, M. W., 9 to 10. Quizzes, 3 sections, Th., 8 to 9; M. W., 11 to 12. Laboratory, 3 sections, M. W. F., 1 to 3:30.

(2) **Qualitative Analysis.**—Lectures and recitations two hours per week on the theory and practice of qualitative analysis. Laboratory practice two afternoons per week in the analysis of simple salts, complex mixtures, ores and minerals. Prerequisite: Chemistry (1). Text book: *Qualitative Analysis*, by Baskerville and Curtman. I, 4. M. W., 10 to 11. T. Th., 1 to 3:30.

(3) **Quantitative Analysis.**—Two lectures and recitations per week on the theory and technique of the laboratory methods and chemical calculations. Five hours of laboratory work per week. The analyses required in the course include the following: Magnesium sulphate, potassium alum, iron ammonium alum, iron ore, limestone, clay or slag, zinc, lead, copper, manganese, arsenic, antimony, and nickel ores alkalimetry, acidimetry and flue gas. Prerequisite: Chemistry (1) and (2). Text books: *Miller's Notes on Quantitative Analysis for Mining Engineers*; *Treadwell's Quantitative Analysis*; and *Miller's Calculations of Analytical Chemistry*. I and II, 8. Hours to be arranged.

(4) **Organic Analysis.**—Lectures and recitations on the methods used for the analysis of organic substances and agricultural products. The laboratory portion of the course includes analysis of the following: Feeding stuffs and cereals, fertilizers, soil, sugar, milk, butter, oils, alcohol, glycerol, formaldehyde, and the detection of adulterations in food. Prerequisites: Chemistry (3) and (5). Text book: Proximate Organic Analysis, by Sherman. I and II, 8. Hours to be arranged.

(5) **Organic Chemistry.**—An elementary course designed to make the student familiar with the principles of organic chemistry and with the more important compounds of both the aliphatic and aromatic series. Remsen's Organic Chemistry is used in the class room and the laboratory work is based on Orndorff's Laboratory Manual, and Gaettermann's Practical Methods of Organic Chemistry. Prerequisites: Chemistry (1) and (2). II, 5. Tu. Th. F., 9 to 10. T. Th., 1 to 3:30.

(6) **Advanced Inorganic Chemistry.**—Lectures and recitations on general theoretical chemistry in which special attention is given to the study of the elements according to the periodic classification of Mendeleeff. Prerequisites: Chemistry (1), (2) and (5). I and II, 6. Hours to be arranged.

(7) **Agricultural Chemistry.**—This course is designed especially to meet the needs of the students in the four-year course in agriculture. Lectures and recitations on the chemistry of soil, manures and fertilizers, plants, and animal products. The laboratory work includes the following analyses: Magnesium sulphate, potassium alum, iron and ammonium alum, soil, cereal or feeding material, milk or butter. Text books: Ingle's Manual of Agricultural Chemistry; Lincoln and Walton's Quantitative Analysis for Agricultural Students. Prerequisites: Chemistry (2) and (5). I, 4, and II, 2 or 4. W. F., 10 to 11; W., 1 to 3:30; F., 8 to 10.

(8) **Food Chemistry.**—This course is designed for students in the home science and the two-year pharmacy courses. The first few weeks of the course deal with organic chemistry, which will serve as a preparation for the study of the composition of different foods, and their functions, the preservation and adulteration of foods. The class work will be supplemented with appropriate laboratory exercises. Prerequisite: Chemistry (1). Text books: Outlines of Organic Chemistry, by Moore; Sanitary and Applied Chemistry, by Bailey. I, 5. T. Th. F., 9 to 10. T. Th., 1 to 3:30.

(9) **Industrial Chemistry.**—Lectures and recitations on the applications of chemistry to industrial problems. In general the course includes fuels, refractory materials, limes, mortars, and cements, timber and its preservation, iron and steel, water, illuminating gas, explosives, and lubricating oils. The lectures are supplemented by laboratory exercises in quantitative analysis. Prerequisite: Chemistry (1), (2) and (3), I or II, 5. Hours to be arranged.

(10) **Water and Air Analysis.**—A course designed for students in sanitary engineering. The sanitary analysis of water and air, with dis-



cussions on the proper interpretations of analytical results. Prerequisite: The first semester of chemistry (3) and chemistry (5). Text books: Mason's Water Supply, and Richard and Woodman's Air, Water and Food. II, 2. Hours to be arranged.

(11) **Animal Nutrition.**—Lectures on the functions of fats, carbohydrates, protein, and salts in nutrition, together with a study of the chemistry of digestion and metabolism. Prerequisite: Chemistry (5) or (8), and biology (3). Text book: Chemistry of Food and Nutrition, by Sherman. II, 3. M. W. F., 10 to 11.

(12) **Mineralogy.**—Blowpipe analysis, elementary crystallography and determinative mineralogy. Lectures and laboratory work. Text book: Moses and Parson's Mineralogy. I, 3 or 4. Hours to be arranged.

(13) **Assaying.**—Conferences, recitations, and laboratory work. Testing the purity and reducing power of fluxes, fire assay for lead, gold and silver ores, and gold and silver bullion, chlorination assay, cyanide and amalgamation tests. Prerequisites: Chemistry (3) and (12). Text book: Fire Assaying, by Fulton. II, 4. Hours to be arranged.

(14) **Photography.**—Lectures on the chemistry and manipulation of photographic processes. Demonstrations in exposing, developing, printing, toning, making lantern slides and enlargements. I, 2. T. Th., 10 to 11.

(15) **Seminar: Abstracting.**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors where the topics are freely discussed. Students are thus kept in touch with the progress of the science. I and II, 2.

(16) **Thesis.**—Students in the chemistry course are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible. I and II, 4.

### ENGLISH.

Professor Brewer.

Mrs. Herrick.

Mr. Gilruth.

The library has abundant equipment for all the work offered in English. There are complete standard texts of practically all the authors referred to in any of the courses. Besides these there is a fair supply of biographical, critical and historical works, sufficient for ordinary reference use. The library equipment is complete enough so that thus far students have been able to do the reading assigned without the necessity of purchasing many books.

Though many classic novels are to be found on the shelves, no effort has been made in the college library to provide current fiction.

In all the courses in English, written work plays an important part. That this work may be kept up to the proper grade, it is announced here

that in college English work no paper will receive any credit that shows notable carelessness or ignorance in elementary matters of punctuation, grammar, rhetoric, or in the spelling of common words.

(1) **English Composition.**—The course is required of all freshmen. The course is almost altogether practice in various types of prose composition; narration, description, exposition, criticism, and argumentation. The class meets ordinarily twice a week. The instructor from time to time meets each student for private conference about his work. Lectures. I and II, 4. Mr. Gilruth. Two divisions. M. W., 10 to 11. T. Th., 11 to 12.

(2) **Expository Composition.**—This is a course primarily in expository writing and intended for students who will go into scientific or technical work. Papers prepared in scientific or technical courses, if not too technical, may be handed in as part of the work of this course. The year's work may also include some practice in business correspondence and in argumentative writing in preparation for English (5). I and II, 4. Prof. Brewer. Two divisions. T. Th., 8 to 9. T. Th., 10 to 11.

(3) **Advanced Composition.**—This is an advanced course for those who wish to study composition as a fine art. It will include a study of the historical development of English prose style and such other work as may suit the taste or needs of those who elect the course. Lectures. I and II, 4. Prof. Brewer. Hours to be arranged.

(4) **Public Speaking.**—Informal lectures; drill in articulation and intonation. Declamation exercises with criticism by instructor and students. Extemporaneous speaking and training in the writing of the different forms of public discourse. The course will close with a study of the essential principles of debating; each student will be required to take part in at least one debate. Required of all freshmen. I and II, 2. Mr. Gilruth. Two divisions. F., 9 to 10. W., 11 to 12.

(5) **Argumentation and Debating.**—Study of the principles of argumentation and master pieces of forensic oratory. Preparation of briefs and forensics. Conferences, lectures, debates and other forms of public address. Elective for seniors and juniors who have credit for courses (1), (2) and (4). I and II, 4. Mr. Gilruth.

(6) **Interpretive Reading.**—This course will include work in the cultivation of the voice and the study of gesture, together with a large amount of drill in interpretive reading from standard literature, both prose and poetry, and especially in oratory and the drama. It is intended for those who expect to take part in oratorical or declamatory contests, and in college plays. It is elective for sophomores, juniors, and seniors. Prerequisite: English (1) and English (4). With the consent of the instructor, it may be taken in the first half-year separately. I and II, 4. Mrs. Herriek.

(10) **English Literature.**—A reading course in English literature including about twenty of the more important authors. A large amount of reading is required and more recommended. Written reports on the



reading are frequently required. A part of the class room time is given to critical reading of English masterpieces. Lectures, recitations, and conferences. I and II, 4. Prof. Brewer. M. W., 9 to 10.

(11) **English Essayists of the Nineteenth Century.**—A study of the more important essayists from Charles Lamb to R. L. Stevenson. Lectures and recitations. I and II, 4. Prof. Brewer. Hours to be arranged.

(12) **Shakespeare.**—A careful reading of three plays in the class room, and outside reading in other plays of the period. Lectures and recitations. II, 4. Prof. Brewer. Hours to be arranged.

(13) **Victorian Poetry.**—A study of the poetry of the Victorian period, with special reference to the work of Alfred Tennyson, Robert Browning, and Matthew Arnold. Lectures and recitations. I and II, 4. Prof. Brewer. Hours to be arranged.

Course 10 is given every year and is prerequisite to courses 11-13. Courses 11-13 are not all given in the same year. Classes will be organized when a sufficient number of students elect any course.

**Special Assigned Composition.**—In accordance with a vote of the faculty, any college student who in any department hands in a theme, thesis, examination paper, lecture notes, or other written work which shows deficiencies in English, may be referred to the department of English with the paper in question and work will be assigned him of such kind and amount as to provide against any recurrence of poor work. Satisfactory completion of any such assignments will be requisite for graduation, but no credits will be allowed for this work.

## FRENCH AND SPANISH.

Miss Wallin.

(1) **French.**—First year's work includes elements of grammar based on Fraser and Squairs' French Grammar, with constant practice in pronunciation, dictation, and conversation. Reading of easy texts. I and II, 8. M. T. W. F., 8 to 9.

(2) **French.**—Review of grammar. Typical fiction and dramas of the nineteenth century are studied. Advanced composition and original theme writing. Conversation and dictation. I and II, 6.

(3) **French.**—Study of classic French literature of the seventeenth and eighteenth centuries, such as Corneille, Racine, Moliere, LeSage and Voltaire. Collateral reading and reports. Lyric poetry. I and II, 6.

(20) **Spanish.**—Hill and Ford's Grammar, reading, composition. Much attention is given to pronunciation. Reading of such texts as Valera's *El Pajaro Verde*, Alarcon's *El Sombrero do Tres Picos*, and Moratin's *El si de las Ninas*. I and II, 8. M. T. W. Th., 11 to 12.

## GEOLOGY.

Mr. Barnes.

The aim of the course in geology is to give the student a comprehensive view of the science as a whole. While geological processes and their results are given considerable attention, other phases of the subject are not entirely neglected. Thus, the course also includes a brief

discussion of the principal types of rocks and rock minerals; as well as a number of the more important applications of economic geology, especially in connection with the origin of some of our more important ore bodies. The work closes with a consideration of some of the later theories in regard to the earth's formation, and a brief review of the earlier stages of the planet's history. As far as time permits the applications of the science to agricultural and engineering problems are especially emphasized.

The college museum, containing an excellent collection of minerals, rocks, and fossils, is constantly drawn upon for illustrative material. In addition, the publications of the United States Geological Survey are at the command of the student, and are used as references in connection with special topics. A set of lantern slides is used for illustrating many of the lectures. Besides the class room work a number of field trips are taken by the class, where the action of geological forces in the past are pointed out and studied. The college is located in an excellent region for this field study, and many interesting phases of the subject are presented close at hand. The field work is concluded with a one-day trip to Morrison Cave, a very interesting formation lying about thirty miles west of Bozeman.

(1) **Geology.**—Lectures, recitations, and assigned reading in dynamical and structural geology. Text: Chamberlin and Salisbury's College Geology. Prerequisite: Chemistry (1). II, 3. M. W. F., 10 to 11.

#### GERMAN.

Miss Cehrs.

(10) **German.**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes pronunciation, grammar, selections in prose and verse, with practice in speaking and writing German. I and II, 8. M. T. W. F., 8 to 9.

(11) **German.**—A continuation of the above course. The work consists of reading of texts suitable for second year work; for the most part, the writings of contemporary authors. Memorizing of easy colloquial sentences and poems. Conversation and composition. An effort is made to familiarize the student with the customs, life and spirit of the German people. I and II, 8. M. T. W. Th., 11 to 12.

(12) **German.**—This course, open to freshmen, is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics will be studied; also scientific texts if desired. Conversation and composition. I and II, 8. M. T. W. F., 8 to 9.

(13) **German.**—An elective course offered to those who have completed course (11) and (12). It consists chiefly of advanced reading of a practical, scientific or literary character, as the needs of the students electing it may dictate. I and II, 8.

## HISTORY.

Assistant Professor Brewer.

The department has a set of MacCoun's historical charts of the United States and two sets of historical geography charts of Europe by the same author; Johnston's series of maps of ancient geography; ten of Breitschneider's maps of medieval Europe; and a set of maps of the modern world.

The library contains the laboratory of the historical department, but a catalogue of the histories would be too voluminous to include here. In Greek and Roman history, besides the standard narrative works, there are translations of the best source material for this period. For English history the library is well equipped with general works and has source material including Colby, Lee and the University of Pennsylvania collection, Evelyn's Diary, a file of "The Gentleman's Magazine," etc.

Naturally the works on the United States history are the most numerous. The standard general histories, as well as works on limited periods or regions, and the best biographies of American statesmen, are in the library. The reports of the American Historical Association, and the Congressional Records, come to the library. There are also many contemporary records, among which are the Old South Leaflets, Hart's American History Told by Contemporaries; the complete works of Jefferson, Hamilton and other statesmen, and the Jesuit Relations.

The college has a reflectoscope installed in the class room, which is at all times available for showing pictures of historic scenes and objects. A large number of views belonging to the teacher are used in all classes.

(1) **European History.**—It is taken for granted that the student has had a preparatory course in general history, with some such text as Myers or West. In this course constant study of the text book is supplemented by lectures on the English constitution and on the development of continental Europe. Special topics with library references are occasionally assigned. I and II, 6. M. W. F., 10 to 11.

(2) **Medieval History.**—The student is supposed to have had courses which have given him knowledge of the great epochs in history and their relations to each other. Therefore, in this course he will take up the thorough history of one period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available in translations. In this connection the student will be given practice in the application of the fundamental rules used in testing the value of historical material. I and II, 6. M. W. F., 8 to 9. (The Renaissance in Italy, given in 1913-14).

(5) **American History.**—This is a course in United States history covering the period of constitutional development and with special reference to that development. The use of the library rather than of any text book is required in this course, and the student is expected to spend about one-fourth of the time in the preparation of a paper on some selected subject. Course 2 should precede this course. I and II, 6. (Given in 1912-13). M. W. F., 8 to 9.

(6) **Thesis.**—For research work in his senior year the student is allowed to select any historical subject which he is qualified to investigate; and for which some material is available either in translation or original.

### HOME SCIENCE.

Professor Harkins.

Assistant Professor Ballinger.

Miss Hess.

The third floor of the new agricultural building is occupied by the home science department. At the north are two kitchen laboratories, on either side of the hall. One, 34x26 feet, has two coal ranges, several electric stoves and desks for 16 students. The other, 27x26 feet, has one coal range and fourteen desks, fitted with individual gas stoves. All tables are well supplied with cooking utensils. Adjoining the east kitchen is a dining room, and beyond it the department office. With the other kitchen is a student lunch room, 25x23 feet, connected by folding doors with the class room. There are also store rooms, pantries and cold storage rooms.

In the south end of the building is a large sewing room, 47x31 feet, with a class room, 31x16 feet, two small fitting rooms, and cases for the work of 104 students. Connected with these are two small sewing rooms, and a bedroom. The department has nine sewing machines of various makes, electric irons, cases for exhibition work, looms for rug weaving, and large and small work tables.

(1) **Principles of Cookery.**—This work includes both lecture and oratory work on the composition and preparation of foods. Lectures on marketing and care of food materials; also visits to the various markets. The object of the course is to teach plain cooking based upon scientific principles. Text: Norton's Food and Dietetics. Lecture, 1; laboratory, 3. II, 4. T. Th., 9 to 11. W., 1 to 3:30.

(2) **Food Studies.**—This course is designed to make practical application of the science underlying the selection and preparation of foods. The dishes prepared illustrate the scientific principles involved. Prerequisites: Home science (1); chemistry (1) and (5). Lecture, 1; laboratory, 3. II, 4. Th., 9 to 10. M. T. Th., 1 to 3:30.

(3) **Home Architecture, Decoration and Sanitation.**—Evolution of the home, modern houses; site, surroundings, construction, heating, lighting, plumbing and drainage. Practice in drawing floor plans of houses. Lectures on the history of furniture, floor coverings and wall hangings, economic problems in house furnishings. II, 3.

(4) **Advanced Cooking.**—In this course menus are planned and meals prepared. The student has instruction in the making of a few difficult and fancy dishes. Prerequisites: Home science (1) and (2). Laboratory, 2. I, 2. M. W., 8 to 10.

(5) **Home Nursing and Invalid Cookery.**—The work in home nursing includes lectures and demonstrations by local physicians and trained



nurses. Invalid cookery includes a consideration of the diet under abnormal conditions; the preparation of invalid dishes; and the dietetic treatment of certain diseases. Prerequisites: Home science (4); Chem. (5); Biol. (12). Lecture, 1. laboratory, 1. II, 2. M. W., 8 to 10.

(6) **Dietetics.**—This course treats of the fundamental principles of human nutrition and metabolism, the relation of food to health, and the construction and preparation of dietaries. Prerequisites: Home science (2); chemistry (5); biology (12). Lecture, 1; laboratory, 1. I, 2. Th., 11 to 12. M., 1 to 3:30.

(7) **Household Management.**—Organization of the household; expenditure of income; education for the home; household accounting; care of the house and other essentials of a well ordered home. Prerequisite: H. S. (3). II, 3.

(8) **Teachers' Course.**—In this course both the theory and practice of teaching domestic science is given. A study is made of the courses of study in various institutions. Courses of study are planned for graded schools, high schools, and colleges. Each student has work in practice teaching. Prerequisites: Home science (1), (2), (3), (4), (5) (6) and (7). Lecture, 2; laboratory, 1. II, 3.

(9) **Seminar.**—A study of the various phases of home science. In this course the student gives at least three lectures on some home science problem; it is then discussed by the class. I, 2.

(10) **Home Problems and Demonstrations.**—Individual problems in food work. Food demonstrations. Laboratory, 2. I, 2.

(11) **Elementary Clothing.**—The fundamental principles of hand and machine sewing applied to the making of aprons and undergarments. Taking measurements, drafting, use of patterns and computation of cost. The drafting system and apron materials are included in the fee. Other materials provided by the student, subject to approval of instructor. Finished garments are the property of the student. I, 3. T. Th. F., 1 to 3:30.

(12) **Dressmaking.**—A course in sewing applied to the making of shirtwaists and simple cotton dresses. Designing and drafting patterns. Computation of costs. I, 2. M. W., 9 to 11.

(13) **Textiles.**—This course comprises a study of fabrics, beginning with their place in primitive life and tracing their development, manufacture, and economic value up to the present time. Prerequisites: Chemistry (1); home science (11) and (12). I, 2.

(14) **Advanced Dressmaking.**—This course includes the making of a woolen dress or suit and a dress for afternoon or evening wear. II, 3. M. W. F., 1 to 3:30.

(15) **The Teaching of Domestic Art.**—Fine hand sewing and its application to garments chosen as problems in a sewing course; lesson plans, courses of study and equipment. Prerequisites: Home science (11), (12), (13) and (14). I, 2.

(16) **Embroidery.**—This course deals with the principal stitches used in decorative art. The decoration of household linens, undergar-

ments and dresses is given attention. The designs are to be worked out in the art department. II, 2. T. Th., 1 to 3:30.

(17) **Thesis.**—Students in the home science course are required to prepare a thesis on some subject pertaining to home science.

(18) **Special Credits.**—Students who have practiced teaching in the Bozeman public schools or in the college will be allowed credits (not to exceed 2) for this work.

### LATIN.

Miss Brewer.

(1) **Virgil.**—Six books of the Aeneid are read. Metrical reading of Latin is required constantly. The students are encouraged to make metrical translations and paraphrases. Recitations. I and II, 8.

(2) **Livy and Horace.**—The special aim in this year's work, as in the previous course, is to enable the student to acquire facility in reading and a literary appreciation of the authors read. Recitations. I and II, 4. T. Th., 9 to 10.

### MATHEMATICS.

Professor Tallman.

Miss Bull.

The students in this department have access to the following journals: American Journal of Mathematics (complete set); Annals of Mathematics (from 1900); Bulletin of American Mathematical Society (1898 to date); also about 200 volumes of recent treatises on mathematics. It may also be mentioned that our library is especially well equipped with treatises and journals of applied mathematics found in the libraries of the engineering and physics departments.

(1) **Algebra.**—Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and groups, binomial theorem, theory of limits, undetermined co-efficients, logarithms and an introduction to the theory of equations. I, 3. M. W. F., 8 to 10, and M. W. F., 10 to 11.

(2) **Plane Trigonometry.**—For engineering and science students. I, 2. T. Th., 10 to 11.

(2a) **Plane Trigonometry and Logarithms.**—For agricultural and home science students. I, 3. M. T. Th., 11 to 12; and M. T. Th., 8 to 9.

(3) **Analytical Geometry and Calculus.**—This course includes the geometry of the straight line and conic section coupled with the elements of differential calculus. II, 4. M. T. W. Th., 8 to 9. M. T. Th. F., 10 to 11.

(4) **Analytical Geometry and Calculus (continued).**—This course which deals largely with the differential and integral calculus also takes up some problems in analytical geometry not treated in course (3), especially the geometry of three dimensions and also includes an introduction to differential equations. I and II, 10. M. T. W. Th. F., 9 to 10.

(5) **Method of Least Squares.**—I, 2. T. Th., 8 to 9.

(6) **Theoretical Astronomy.**—Integration of equations of motion, computation of orbits and ephemerides. This course should be preceded



by course (5) in physics and must be preceded by course (4) in mathematics. I and II, 6.

(7) **Applied Algebra.**—This course is designed for students who do not expect to go further into the study of mathematics. Starting with a review of some of the fundamentals of elementary algebra the course deals with such subjects as ratio and proportion, mathematical inductions, probable results and errors from experimental data, etc., as will assist the students in their scientific work. For agricultural and home science students. II, 2. M. W., 8 to 9.

(10) **Differential Equations.**—Ordinary and partial differential equations with geometrical and mechanical applications. I and II, 6. M. W. F., 8 to 9.

(11) **Partial Differential Equations of Mathematics-Physics.**—This course will be based on Weber's "Die Partiellen Differential Gleichungen der Mathematischen Physic," and Byerly's "Spherical Harmonics." A great many applications to concrete problems will be made throughout the course. I and II, 6.

(12) **Newtonian Potential.**—Lectures on the theory of potential, with an introduction to spherical harmonics. I and II, 4.

(13) **Algebra (Advanced.)**—This course will be an extension of course (1), and will contain discussion of complex numbers, theory of algebraic functions, etc. Care will be taken to show the practical application of each subject as the work advances; that is, such subjects as the connection between complex numbers and alternating currents, etc., will be fully explained. I and II, 6.

(14) **Analytical Geometry (Advanced.)**—This course is a continuation of course (4). As the time given in course (4) for geometry of three dimensions is very limited it will receive considerable attention in this course. I and II, 6.

(15) **Thesis.**—Students specializing in mathematics are required to present a thesis on some chosen subject. The subject must be chosen and approved not later than November 15 of the senior year. A great deal of work in this line is desired, as it is believed there is no better way of developing a habit of independent thought.

Only a selection of courses (10) to (14) will be given each year, those being chosen for which most students apply. The special object of our work here is to make the course in applied mathematics complete, and the work in pure mathematics will have as its object the laying of a good foundation for the more advanced work in applied mathematics. Those desiring to do work which is not offered in the above courses may consult the professor in charge of the department.

## PHILOSOPHY AND ECONOMICS.

President Hamilton.

(1) **Psychology.**—This course presents a general view of modern psychology and is required of all general science students. It gives a practical exposition of the materials and methods of psychological investi-

gation. The lectures are accompanied by class demonstrations. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training, the higher intellectual faculties, and the will. So far as possible the work is made practical and concrete. I, 3. M. T. Th., 9 to 10.

(2) **Ethics.**—The work in ethics includes a study of the evolution of conduct, moral standards, the social and industrial life, the development and trend of ethical thought and an examination of utilitarianism. II, 3. M. T. Th., 9 to 10.

(3) **Economics.**—This course consists of a study of such subjects as land, capital, labor, money, coinage, banking, rent, interest, wages, and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, cooperation, recent currency legislation, and the single tax. I and II, 4. M. W., 11 to 12.

(4) **Sociology.**—The origin and history of human society, the various social theories and the laws of human intercourse are treated. Attention is given to such practical subjects as the government of cities, settlement work, the enrichment of country life, and charity work. Lectures and recitations. Elective. I or II, 3.

### PHYSICS.

Professor Ham.

Miss Higgins.

The following courses in physics are designed to meet the needs of (1) those students who are preparing to take up some of the more technical studies in engineering or agriculture, (2) those who expect to become physics or science teachers, and (3) those general science students who wish to acquire some of that kind of scientific training which is peculiar to the science of physics alone.

The facilities at the disposal of the physics department are described below somewhat in detail.

The lecture room is located in the basement of the chemistry and physics building. The lecture desk is supplied with gas and both alternating and direct current circuits. A projection lantern is permanently set up and is used constantly to illustrate the class room exercises. A large collection of lantern slides has been prepared, which cover the whole subject of physics. The apparatus for lecture demonstration has been carefully selected and is sufficiently complete for giving experimental illustrations of all the principles of the science that are usually included in college courses.

For laboratory instruction three well lighted and conveniently furnished rooms are provided on the second floor of the building.

One of these rooms is equipped for electrical measurements and is wired with both alternating and direct current circuits, conveniently arranged for experimental purposes. The galvanometers are permanently located in convenient positions. The following forms are available: Tangent astatic, Thompson, differential, Northrup, and eight forms of

the D'Arsonval type, including two with ballistic suspensions. In addition to the above equipment the following instruments are used in the various experiments taught, viz: magnetometer, standard resistance and condenser, an air condenser for determining the ratio of the electrostatic to the electromagnetic units, Carhart-Clark cells, wire and box forms of the Wheatstone bridge, Carey Foster bridge, Callendar and Griffith's bridge, rheometer, electro-dynamometer, ammeters, voltmeters, Leed's potentiometer, platinum thermometer, thermocouples, earth inductor, standard solenoid, Thompson integrating wattmeter, and a permeameter with ten different specimens of iron for experiments in magnetization and hysteresis.

The second laboratory is furnished and equipped for teaching mechanics and heat. The equipment includes the following: micrometer and vernier gauges, spherometer, cathetometer, balances and weights, hydrometers, Atwood's machine, Young's modulus apparatus, torsion apparatus, torsion pendulums, apparatus for resolution and composition of forces, impact, harmonic motion, principle of moments, centrifugal force, and surface tension; simple and Kater's pendulums, a laboratory clock, thermometers, air thermometer, calorimeters, expansion apparatus, hygrometers, Searle's mechanical equivalent of heat apparatus.

The third laboratory is used for the study of light and sound and also for the elementary classes in the preparatory school. The equipment for teaching light and sound includes the following: a photometer, spectrometer, spectroscope, mirrors, prisms, lenses, diffraction gratings, optical bench, Fresnel mirror and bi-prism, apparatus for polarized light, microscope, telescope, and an Abbe refractometer, sonometers, Kundt's tubes, siren, Lissajous apparatus, and Helmholtz resonators.

For the study of radioactivity and allied phenomena, there is a large induction coil, a variety of Crookes' and X-ray tubes, Wilson electroscopes, radium compounds and other radio-active material.

The physics library is located in one of the laboratories for students' use. It contains many of best books and general works on physics, and the current numbers of the Philosophical Magazine, the Physical Review, Science Abstracts, Section A, Bulletins of the Bureau of Standards, and School Science and Mathematics.

(1a) **General Descriptive Physics.**—Two lectures, and laboratory work two and one-half or five hours per week in mechanics, heat, light and electricity. Special attention is given in this course to the study of such physical principles as those involved in the capillary action of soils, the osmotic action of plants, the movements of winds and moisture, the causes of the deposition of dew and the prevention of frost. Physics (1a) is prescribed in the courses in agriculture and biology. Prerequisites: Mathematics (2) or (2a), and physics (a) or its equivalent. Text books: General Physics, by Crew; Laboratory Course, by Sabine; Laboratory Physics, by Miller. I and II, 6 or 8. M. W., 11 to 12; M., 1 to 3:30.

(1) **General Physics.**—Lectures, recitations, and assigned problems,

three hours per week throughout the year on mechanics, heat, magnetism, and electricity. This course is more mathematical and technical than physics (1a) and is particularly designed to meet the needs of students in engineering and the science students in the mathematics-physics course. Students who have not completed the calculus, mathematics (4), are required to take it during the same year that physics (1) is taken. Text book: General Physics, by Hastings & Beach. I and II, 6. M. W. F., 10 to 11.

(2) **Physical Measurements.**—A laboratory course designed to supplement physics (1). It is strictly quantitative and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to offer a training in making measurements of precision. Text books: Mechanics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. I and II, 4. T. Th., 1 to 3:30.

(3) **Light and Sound.**—Lectures and recitations two hours per week on wave motion, the theory of light in its application to familiar optical phenomena and to optical instruments, and on the phenomena and laws of sound. Prerequisites: Physics (1) and (2). Text book: Light and Sound, by Franklin & McNutt. II, 2. T. Th., 8 to 9.

(4) **Physical Measurements.**—A laboratory course in light and sound to supplement physics (3). II, 2. T. Th., 1 to 3:30.

(5) **Electricity and Magnetism.**—Two lectures and two laboratory periods per week on methods for the exact measurements of resistance, electromotive force, current, capacity, and the co-efficient of self-induction. The calibration of commercial instruments, insulation testing, and magnetic measurements, such as finding the permeability and the hysteresis effects of different samples of iron, will also be included in this course. Prerequisite: Physics (1) and (2) and differential and integral calculus. I, 4. T. Th., 8 to 9; W. F., 1 to 3:30.

(6) **Advanced Physics.**—Physics (6) is primarily a laboratory course and is offered as an elective to science and engineering students. Conferences and assigned reading are essential features of the course. A more complete study of the precision of measurements will be made than was attempted in physics (2).

There are four separate parts to this course from which the work desired may be selected.

(a) **Heat.**—A study of exact methods of thermometry, pyrometry, calorimetry and determination of the mechanical equivalent of heat. Prerequisite: Physics (1), (2) and (5). II, 3.

(b) **Light and Radioactivity.**—Conferences, assigned reading and a series of standard laboratory experiments to illustrate diffraction, interference and polarization of light, spectroscopy, photometry, conduction of electricity through gases, and the phenomena of radioactivity. Prerequisite: Physics (3) and (4). II, 3.

(c) **Electricity and Magnetism.**—This course is offered as an elective in the science and electrical engineering courses to those who wish to



continue the subject beyond the requirements of physics (5). I, 3.

(d) **Pedagogy of Physics.**—This course will be modified from year to year to suit the needs of the individual student. In general the course will include discussions of the methods of teaching, the selection and performance of effective lecture table and laboratory experiments and practice in presenting the topics covering such experiments to elementary and college classes. Prerequisite: Physics (1), (2), (3) and (4). I, 3.

(7) **Thesis.**—Students in the mathematics-physics group who elect physics as their major subject are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible.

### SECRETARIAL SUBJECTS.

Prof. Brewer.

Miss Jones.

(1) **Shorthand.**—A thorough knowledge of the fundamental principles of shorthand practice in word building, phrasing and dictation. I and II, 8. M. T. W. Th., 9 to 10.

(2) **Shorthand.**—Practice for the purpose of acquiring speed. Actual correspondence, reports of addresses, legal papers and miscellaneous matters to acquire a large shorthand vocabulary. I and II, 6.

(3) **Typewriting.**—Instruction in the use and care of typewriters. Exercise for the development of proper wrist and finger movements and for the mastery of the keyboard. Practice in letter writing and the use of carbon. I and II, 8. T. W. Th. F., 1 to 3:30.

(4) **Typewriting.**—Practice in transcribing from shorthand notes and from manuscript. Dictation for the attainment of speed and accuracy; also practice in the use of the mimeograph. I and II, 6.

(5) **Business Correspondence.**—A practice course in all forms of business correspondence. Attention is paid to spelling, punctuation, paragraphing and the correct arrangement of materials, both as to form and language. II, 3. M. T. Th., 11 to 12.

(6) **Office Practice.**—Practice with the various kinds of office appliances and equipment, such as adding machines, duplicators, filing cases and card systems. Preparing copy for press and proof reading, typography and illustration. I and II, 4.

(7) **Business Methods.**—A practical course in business methods, including the principles of business organization and administration. How to do business with the postoffice, banks, railroads, express, etc. II, 3.

### SCHOOL OF ART.

Miss Baldwin.

Miss Lane.

That the study of drawing is important in education is now universally acknowledged. Aside from the advantages to engineers, machinists, and architects of practical knowledge of draughtsmanship, the psychologic value of a knowledge of drawing is very great. The chief object of education is in the quickening of the powers of the mind.

Drawing brings out the power of analysis, habits of observation, qualities of judgment, imagination, memory and taste. It is something more than mere training of the eye. To achieve even moderate success requires that thought be put into every line. A line put down without thought is always a wrong line.

Art, aside from anything we can produce, helps us to appreciate the work of great artists and opens our eyes to the beauty of form and color in nature. It extends our powers of enjoyment and gives us a better understanding of the history of the human spirit. It gives a proper gratitude for the work of the great artists.

With the coming of the applied arts movement, has come the demand for work in manual training directly related to, and based upon art principles. With this purpose in view courses are offered in artistic handicraft, jewelry, hammered metal, pottery and leather work with all the facilities and equipment needed for artistic and practical work.

Students who are registered in the art courses are admitted without further tuition fees to such other work of the college as their preparation will permit them to pursue to advantage. Attention is called in this connection to the work offered in history, literature, languages, home science, music (which is charged separately) and in engineering and mechanic arts. The art course, as here outlined, will indicate the work of the average student in a four year's course planned for those who attend mainly for art work. The student is carried forward just as rapidly as his own talent and industry will permit.

The course offers thorough training in the study of form, color, ornament, historic art, principles of design and composition and in technical methods in applied design. It insures a broad foundation of art culture and skill which will enable students to make practical use of their training. The theory of design is presented as fundamental to the crafts. Exceptional facilities are offered for the study of design and composition and the course is strengthened by the many phases of related art work carried on in the school. Every effort is made to teach drawing. The pupil is then encouraged to follow any line of art work for which he seems best fitted. For example, a pupil may elect to specialize in handicraft. Having completed the required work in drawing and design he may study any handicraft for which he has developed some ability or shown especial talent.

Attention is called to the regulation printed on page 19 regarding work done suitable for exhibition purposes.

Art schools unrelated to colleges have often lacked the finer influences of literature, the broadening environment, the healthy stimulus of systematic work and the wider circle of social life. It is thus a decided advantage for the art school to have the association with the religious, social and literary life of the college.

For admission to the course in art, the requirement is the same as for the regular degree course, fifteen units of preparatory or high school work. For a detailed statement of the requirements see page 14.



**ART COURSE.****FIRST YEAR.**

First Semester.		Second Semester.	
Eng. Comp. (Eng. 1).....	2	Eng. Comp. (Eng. 1).....	2
German or French.....	4	German or French.....	4
Drawing (1).....	6	Drawing .....	7
Design .....	4	Design .....	4
Perspective and Comp.....	1	History of Art.....	2
History of Art.....	2		
	19		19

**SECOND YEAR.**

English (10).....	2	English (10).....	2
German or French.....	4	German or French.....	4
Drawing .....	5	Drawing .....	5
Painting .....	2	Painting .....	2
History of Art.....	2	History of Art.....	2
Design and Handicraft. ....	4	Design and Handicraft.....	4
	19		19

**THIRD YEAR.**

History (1).....	3	History (1).....	3
Drawing and Painting.....	6	Drawing and Painting.....	6
Advanced Design and Handicraft	6	Advanced Design and Handicraft	6
Elective .....	4	Elective .....	4
	19		19

**FOURTH YEAR.**

Drawing and Painting.....	6	Drawing and Painting.....	6
Advanced Design and Handicraft	6	Advanced Design and Handicraft	6
Elective .....	7	Elective .....	7
	19		19

For a description of the art work outlined above see pages 74 and 75 of this catalogue.

**SCHOOL OF MUSIC.**

PAUL P. McNEELY, Mus. B. (Washburn College); A. B. (University of Kansas).

Director of School of Music and Instructor in Piano and Musical Theory.

U. HOLMES BISHOP (New England Conservatory of Music).

Instructor in Voice and Conductor of Singing Organizations.

MISS H. BLANCHE McNEELY (Missouri Valley College).

Assistant Instructor in Piano and Organ.

LOUIS L. HOWARD (Boston Conservatory of Music).

Director of Band and Instructor in Band Instruments.

**ADVANTAGES OF COLLEGE INSTRUCTION.**

The advantages of college over private instruction are very numerous and quite obvious to any one giving the matter serious thought. When a student is seeking the services of a private teacher, he must form his judgment as best he can on that person's fitness for his vocation, while it is certain that the teachers of a successful college are selected mainly on account of their ability, as it would not be in the best interests of such an institution to sacrifice its reputation by employing other than good teachers. Again, the stimulating atmosphere of a music school is another distinct advantage over private instruction.

The music departments are organized for a four-fold purpose:

1. To combine music and literary studies as a broad basis for regular collegiate instruction.
2. To use the art of music for intellectual, esthetic, and moral culture.
3. To teach all branches of music to special and general students.
4. To educate teachers of music.

**DEPARTMENTS OF INSTRUCTION.**

- I. Course for the pianoforte.
- II. Course for the voice.
- III. Course for the organ.
- IV. Course for harmony, counterpoint, analysis, and history of music.
- V. Course for orchestral and band instruments.
- VI. Instruction in chorus singing.

**GENERAL INFORMATION.**

1. No time limit can be designated for the satisfactory completion of any course on account of difference in degree of musical ability; much also depends upon the preparation made, and upon the amount of time and careful attention the student can devote to the pursuit of a chosen study.

2. Students after 1913 who present themselves as candidates for graduation must have completed a high school course or its equivalent and give evidence of requisite musical talent and capacity. Each student must give during the last year of study one public recital in addition to the final performance at the commencement concert. Students preparing for graduation are required to take two private lessons a week

for two years at least with the head teacher of the department, and it is necessary that resident students should study with teachers of the college for at least two years.

3. For graduation, four semesters' work in harmony will be required, and one year in the history of music.

4. The study of music has been placed upon an equality with other electives, and a limited number of credits may be counted toward a degree.

5. Diplomas will be granted to students who have done satisfactory work and passed the required examinations.

6. Tuition rates are payable in advance for each term of twelve weeks. No reduction will be made for temporary absence from lessons or for lessons discontinued. Lessons missed by the teacher will be made up at the mutual convenience of teacher and pupil.

7. All college students who take work in music shall be enrolled in at least twelve credits of work (including, if so assigned, work in harmony and musical history) in addition to the work in vocal and instrumental music. Students residing at home may be excused by the faculty from such requirements, upon request of their parents. Work is recommended in home science, languages, literature, history and art.

Students not candidates for a preparatory diploma or a college degree, who are taking music in combination with other work of the college, shall be registered by the head of the department of home science.

Those students not taking other college work are classed as "Music Specials."

8. The department is closed on the college and national holidays. Lessons falling on these days will not be made up.

9. No student is permitted to take part in any public performance without consent of the director.

10. Tuition fees are subject to change from year to year.

### **EQUIPMENT.**

The School of Music of the college occupies half of the third floor of College Hall. The large assembly room is used for recitals. The school is well equipped with pianos, both grand and upright.

### **CONCERTS AND RECITALS.**

Concerts are frequently given by the instructors and advanced students.

Recitals are given monthly by the students of the school, at which work studied in the class room is performed before a small audience of fellow students and friends. Every student is required to take part in the programs at least twice a year. These semi-public appearances are of great assistance in enabling the student to acquire the ease and self-possession so essential to a successful public performance.

### **ENSEMBLE AND SIGHT PLAYING.**

In this branch of instruction lie indispensable elements of musical

culture, to be obtained through no other mode of training.

Ensemble training develops the pupils' ability in reading at sight, and enables them to acquire a knowledge of compositions ordinarily inaccessible to the pianoforte student.

Prima-vista reading of four-hand arrangements, and transcriptions of the symphonies, operas, string quartettes and chamber music generally, for two pianos, are studied. Piano accompaniment playing for voice and solo instruments receives special attention.

During the year, one or more ensemble recitals are given.

### PIANO DEPARTMENT.

The regular course in piano-forte is covered by five grades, Preparatory, Freshman, Sophomore, Junior and Senior; and the Post Graduate course by one. Examinations will be held twice a year—at the end of each semester. Regular students may not pass from any grade without examination. While it is not obligatory for students to take these examinations, yet they are encouraged to take them because they have something definite before them, their ambition is stimulated and a better quality of study is secured. The pieces used for these examinations will be chosen from a list arranged by the director of the music department.

Special attention will be paid to the following points in the examinations:

Excellence of technique.

Accuracy of notation and correctness of fingering.

Phrasing and rhythm.

Discretion in use of pedals.

Choice of tempo and steadiness in time.

Quality of touch and tone.

Artistic interpretation.

Memory playing.

### PREPARATORY PIANO COURSE.

Technical exercises—Rieman and later Phillipp, throughout all courses.

Czerny-Germer, Studies II; Duvernoy, School of Mechanism, op. 120; Koehler, op. 50; Heller, op. 45 and 47; Kuhlau's *Kinderleben*; Sonatas by Clementi and Kuhlau.

### COLLEGIATE PIANO COURSE.

#### FRESHMAN EXAMINATIONS.

Candidates must be prepared to play from memory six pieces or sonatas, such as Mendelssohn's *Songs without Words*; Schubert's *Impromptus*; Sonatas by Haydn and Mozart; or other appropriate selections from classic and modern compositions.

**Technic.**—All scales, hands together, in quarter, eighth, and sixteenth, separately, staccato and legato; triads in all keys; arpeggios in three positions, hands separately.

**Studies.**—Czerny, School of Velocity; Cramer, Studies; Bach, Two-part Inventions, and French Suites.

## SOPHOMORE EXAMINATIONS.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, and one number of the eight must be prepared without assistance.

Appropriate selections from classic and modern compositions will be studied including Beethoven's Sonatas; Concertos by Mozart, Hummel, etc.

**Technic.**—All scales, hands together, in quarter, eighth and sixteenth notes, metronome at 69. Triads and four-note chords with different touches. Arpeggios formed on all major and minor triads with their inversions, metronome at 84, hands separately, Staccato octaves in any scale required.

**Studies.**—Cramer, Studies, continued; Clementi, Selections from Gradus ad Parnassum; Jensen, op. 32; Bach, Three-part Inventions and English Suites.

## JUNIOR EXAMINATIONS.

Candidates must be prepared to play from memory eight pieces selected by the instructor; one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number of the eight must be prepared without assistance.

Concert selections from classic and modern composers will be studied including Chopin's Preludes; Bach, Well-Tempered Clavichord; Concertos by Beethoven, Mendelssohn, etc. Selections from Henselt's op. 2 and 5.

**Technic.**—Major and minor scales, hands together, similar and contrary motion, metronome at 105. Also major scales, hands together in thirds, sixths, and tenths, metronome at 100. All chord forms. Arpeggios formed on the major and minor chords and on the diminished seventh chords, with inversions, metronome at 92. Staccato octaves in major and minor keys, hands together.

**Studies.**—Gradus continued; Moscheles, Etudes, op. 70; Kullak, School of Octaves; Chopin, Etudes.

## SENIOR EXAMINATIONS.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number must be a concerto. One number of the eight must be prepared without assistance.

Concert selections from Schumann's greatest works (David, Bunder-Tanze or Carnival); Sonatas and Concertos by Beethoven, von Weber, Grieg, etc., and pieces by modern composers.

**Technic.**—All major and minor scales in octaves, tenths, sixths, and thirds, metronome at 120. Scales must also be played with crescendos and diminuendos, two notes against three, and three notes against four. All chord forms, solid and broken, with any touch required. Arpeggios formed on all major and minor chords, also the dominant seventh, and diminished seventh chords, all with inversions, metronome at 108. All octave forms will be required.



**Studies.**—Chopin's Etudes, op. 10 and 25; Rubinstein, Selected Studies; Bach, Well-tempered Clavichord, continued.

#### POST GRADUATE EXAMINATIONS.

Candidates must be prepared to play eight numbers selected by the instructor. One post graduate number of the eight must be prepared by the candidate without assistance.

The most advanced works in the piano repertory will be studied, as Chopin's etudes and Godowski's arrangement of same; modern etudes by Liszt, Birsoni, etc.; Schumann's Etudes Symphonie or a set of Brahms' Variations; concert pieces and concertos by modern composers.

**Technic.**—All scales in similar and contrary motion, the legato in quarter, eighth, and sixteenth notes; staccato (hand and finger touch) in quarter and eighth notes, metronome at 176. All chord forms, solid and broken, metronome at 160. Arpeggios on all major and minor chords; also dominant seventh chords, with inversions, the legato in quarter, eighth and sixteenth notes; staccato (hand and finger touches) in quarter and eighth notes. The seventh chords to be played also in triplet rhythms, metronome 176. Octaves in major, minor and chromatic scales, hand together, in similar motion, with any variety of touch required. The staccato in quarter, eighth and sixteenth notes; the legato and arm touches in quarter and eighth notes only. All major, harmonic, minor and chromatic scales in double thirds, fourths and sixths legato and staccato.

#### MUSICAL THEORY.

The following courses are required of all students in the regular musical courses.

(1) **Harmony.**—The study of overtones, scales, intervals, triads, and seventh chords and their inversions. The practical work consists of harmonizing melodies in soprano or bass and playing chord progressions at the piano. First year, twice a week first semester.

(2) **Harmony.**—The study of close and open harmony, dominant ninth and diminished seventh chords, modulations. Practical work continued. First year, twice a week, second semester.

(3) **Harmony.**—The study of modulation, irregular resolutions, altered chords, suspensions, passing tones, organ point, harmonization of florid melodies. Practical work continued. Second year, twice a week, first semester.

(4) **Musical Analysis.**—Review of harmony, analysis of two and three part song and song with trio. Classical models with original work. Second year, twice a week, second semester.

(5) **Musical History.**—A survey of music from the earliest times. Lectures discussions, and assigned readings. First year, once a week, first semester.

(6) **Musical History.**—This course deals principally with modern music. Lectures, reports and class discussions. First year, once a week, second semester.



**VOCAL DEPARTMENT.**

Instruction in this department aims to develop a high musical taste and ability in the singer, as well as in the voice. Along the course of study is voice placement, vowel study and their application to words; rhythm, phrasing, enunciation, and song interpretation. Songs are selected from the works of the best writers, both foreign and native. Studies in vocalization include works of Conccone, Vaceai, Sieber, Marchesi, Lutgen, etc.

No student of the vocal art can reasonably expect to achieve any great degree of proficiency without a certain amount of general culture. To this end, harmony should be studied; languages, especially German, French and Italian; a good command of English is necessary; chorus work is of an almost indispensable value; and every singer should be able to play on the piano song accompaniments of moderate difficulty.

Candidates for graduation must have completed an accredited high school course or its equivalent; must be able to sing intervals, scales, arpeggios and sustained tones; must have completed one year each of harmony and history of music; two years each of French and German languages and one year of Italian for which Spanish may be substituted; two years of piano (secondary); two years of chorus if required; and must be able to read at sight with a reasonable degree of accuracy. The repertoire should be extensive so as to include compositions of the French, German and Italian masters, as well as those of the English and American writers of note.

**Choruses.**—The choruses are the Hamilton Society and the College Glee Club. The aim of these organizations is to promote college life and spirit and give the students opportunity to develop musically. From time to time public exhibitions are given of the works studied.

**The Hamilton Society** is composed entirely of ladies. The membership being unlimited, its benefits are open to all college girls who have sufficient voice and musical ability.

**The Glee Club** is limited to twelve men and is chosen from the entire student body. Only the best musically and vocally are accepted.

These singing societies are among the most important of the college organizations and the culture gained is very essential to the college student.

**CALENDAR FOR 1912-13.**

The music department has divided the year into three terms of twelve weeks each, or if desired, lessons may be arranged by the College semester.

1912—September 9—Fall term registration begins.

—December 4—Fall term closes.

—December 5—Winter term begins.

1913—March 12—Winter term closes.

—March 13—Spring term begins.

—June 4—Spring term closes.

**TUITION.****With Mr. McNeely.**

For one forty-five minute lesson per week for one term.....	\$25.00
For two half-hour lessons per week for one term.....	32.00
Harmony, for the entire academic year( two lessons a week).....	20.00

**With Miss McNeely.**

For one forty-five minute lesson per week for one term.....	\$18.00
For two half-hour lessons per week for one term.....	22.00
Organ, one hour lesson per week for one term.....	24.00

**With Mr. Bishop.**

One forty-five minute lesson per week for one term.....	\$27.00
Two half hour lessons per week for one term.....	36.00

Students wishing to arrange for vocal or instrumental instruction by the single lesson instead of by the term will be charged \$1.50 per half-hour lesson.

Piano practice may be arranged for at the following prices:

One hour each day 30 cents per week.

Organ practice: One hour each day, 25 cents.

## School of Pharmacy

Professor Mollet.

This school offers two and three-year courses which afford a thorough training in all branches of pharmacy and pharmaceutical chemistry. These courses lead to the degree of Pharmaceutical Chemist (Ph. C.), and qualify the graduate who has had the required experience to meet the examination given in any state for the position of registered pharmacist.

The two-year course requires two full academic years for completion and provides the foundation in biology, chemistry and pharmacology as applied in the various pursuits of the profession of pharmacy.

The three-year course includes the same subjects in chemistry and pharmacy and affords the student an opportunity of extending his pharmacy education with advantage, over a period of three years. This course is especially recommended to applicants who are not high school graduates, or otherwise well qualified to pursue the two-year course.

Candidates for admission must be at least eighteen years of age, unless they are graduates of accredited high schools, or of schools maintaining courses of equal length and rank, and may be admitted: (a) by presenting a certificate of graduation from an accredited high school, (b) by presenting a certificate from an accredited high school, signed by the principal or superintendent, showing that not less than two years of work have been completed; (c) by an examination on an equivalent amount of work in subjects designated by the college; (d) by faculty approval of grades from other than accredited high schools.

Notice is hereby given that the requirements for these courses will be raised in the future.

While it is not compulsory, it is advised that students have one or

two years practical training in a drug store before entering, and in certain cases drug store experience may count towards entrance requirements for the two-year course.

Applicants who furnish the regular college entrance requirements, fifteen units, and complete sixty-five credits of approved work in the college in addition to those outlined in the two-year course may receive the degree, Bachelor of Science (B. S.) in Pharmacy.

In addition to the annual tuition fee of \$12.00, deposits are required as indicated on page. 14.

The students have access to such of the chemical and botanical laboratories as the work calls for, as well as those of pharmacy and materia medica. Those laboratories contain all the modern equipment necessary for the proper instruction of the students. Free access is also granted to the standard reference books, in the several branches of science, and the magazines and journals of biology, chemistry and pharmacy.

Lectures will be given throughout the course on chosen subjects, by those who have gained prominence in pharmaceutical pursuits, and in the sciences closely related to pharmacy. All pharmacy students will be required to attend these lectures.

All regular students will be required to keep notes on the work done, and present the same for examination and rating. Oral and written quizzes will be given during each course, and a final written examination at the close of the senior year covering the entire course of instruction in pharmacy. This examination will resemble those given by the state boards of pharmacy.

This school is recognized by the State Board of Pharmacy, and graduates, upon payment of the regular fee, may receive their certificates of registration without examination, as follows: Those furnishing satisfactory evidence to the Board of having had one year of practical experience in a drug store, may become Assistant Registered Pharmacists, and those having had four years practical experience, may become Registered Pharmacists.

## PHARMACY.

### Three Year Course.

#### FIRST YEAR.

First Semester.		Second Semester.	
English (1 or b, c or d).....	2 or 4	English (1 or b, c or d).....	2 or 4
Introductory Pharmacy (Phar. 1)	4	Official Galenical Pharmacy	
Pharmaceutical Problems		(Phar. 3).....	4
(Phar. 2).....	2	Manufact. Pharmacy (Phar. 4)....	2
General Chemistry (Chem. 1).....	4	General Chemistry (Chem. 1).....	4
Elective.....	3 or 1	Elective.....	3 or 1
	15		15

## SECOND YEAR.

Qualitative Analysis (Chem. 2)....	4	Quantitative Analysis (Chem. 3) 4	
General Botany (Biol. 9).....	5	Plant Phys. and Hist. (Biol. 10) 1	
Pharmacy Latin (Phar. 12).....	3	Physiology (Biol. 3).....	5
Elective .....	3	Pharmacognosy (Phar. 5).....	3
		Elective .....	2
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15		15	

## THIRD YEAR.

Organic Chemistry (Chem. 8).....	5	Animal Nutrition (Chem. 11).....	2
Bacteriology (Biol. 12).....	2	Microscopical Study of Powdered	
Pharmacopoeial Salts (Phar. 6)....	5	Drugs (Phar. 7).....	2
Drug Analysis (Phar. 8).....	3	Materia Medica, Therapeutics	
		and Toxicology (Phar. 9).....	4
		Prescription Reading and Dis-	
		pensing (Phar. 10).....	3
		Urine Anal. (Phar. 11).....	2
		Elective .....	2
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15		15	

## Two-Year Course.

## FIRST YEAR.

General Chemistry (Chem. 1).....	4	General Chemistry (Chem. 1).....	4
General Botany (Biol. 9).....	5	Plant Phys. and Hist. (Biol. 10) 1	
Introductory Pharmacy (Phar. 1) 4		Physiology (Biol. 3).....	3
Pharmaceutical Problems		Manufacturing Pharmacy (Phar.	
(Phar. 2) .....	2	4) .....	2
Pharmacy Latin (Phar. 12).....	3	Official Galenical Phar. (Phar. 3) 4	
		Pharmacognosy (Phar. 5).....	3
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18		17	

## SECOND YEAR.

Organic Chemistry (Chem. 8).....	5	Quantitative Analysis (Chem. 3) 4	
Qualitative Analysis (Chem. 2)....	4	Animal Nutrition (Chem. 2).....	2
Bacteriology (Biol. 12).....	2	Microscopical study of Powdered	
Pharmacopoeial Salts (Phar. 6) 5		Drugs (Phar. 7).....	2
Drug Analysis (Phar. 8).....	3	Materia Medica, Therapeutics	
		and Toxicology (Phar. 9).....	4
		Urine Analysis (Phar. 11).....	2
		Prescription Reading and Dis-	
		pensing (Phar. 10).....	3
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19		17	

**DESCRIPTION OF WORK IN PHARMACY.**

(1) **Introductory Pharmacy.**—This course consists of a study of the authoritative guides; the theory in the use of the common apparatus and processes used in pharmacy; together with practical laboratory training in the use of this apparatus and these processes. Lectures and recitations, 3; laboratory, 1. I, 4.

(2) **Pharmaceutical Problems.**—Two hours per week devoted to the study of the principles of pharmaceutical arithmetic and to practical problems involving weights and measures, relationship of systems, specific gravity and specific volume, reducing and enlarging formulas, percentage solution, concentration and dilution, alligation and thermometric scales. Recitations. I, 2.

(3) **Official Galenical Pharmacy.**—A continuation of course (1) and must be preceded by it; consisting of a thoroughly scientific study of the galenical preparations in the United States Pharmacopoeia and National Formulary. These are carefully considered with regard to classification, nomenclature, mode of preparation, preservation, and percentage composition. Texts, U. S. Pharmacopoeia, eighth revision, and National Formulary, third edition. Lectures and recitations. II, 4.

(4) **Manufacturing Pharmacy.**—A practical laboratory course in which many of the important and difficult medicinal preparations of the U. S. Pharmacopoeia and National Formulary are manufactured by each student, especially the typical representatives of each class of galenicals, viz: waters, liquors, decoctions, infusions, syrups, mucilages, honeys, glycerites, elixirs, spirits, tinctures, wines, vinegars, fluidextracts, extracts, oleoresins, resins, collodions, emulsions, mixtures, pills, powders, granular effervescent salts, cerates, ointments, liniments, oleates, plasters and suppositories. II and I, 4.

(5) **Pharmacognosy.**—A study of the natural history and important features of crude drugs; the means of identification and selection; constituents, and official preparations. The official organic drugs and some of the commonly used non-official ones will be studied in the following order: (a) Plant drugs—Roots, rhizomes, tubers, bulbs, corms, herbs, barks, twigs, woods, leaves, flowers, fruits, seeds, gums, resins, balsams, etc.; (b) Animal drugs. The student has actual access to the typical specimens in the materia medica laboratory. Lectures, recitations, and laboratory exercises. II, 3.

(6) **Pharmacopoeial Salts.**—The official inorganic and organic salts, acids, and the official alkaloids, alkaloidal salts and glucosides are studied with special reference to nomenclature, source, manufacture, physical and chemical properties. Lectures and recitations. I, 5.

(7) **Microscopical Study of Powdered Drugs.**—This course consists of the study of powdered vegetable drugs and their common adulterants by the aid of the microscope. By the preparation of slides and drawings the student learns the most important characteristics of the different drugs most commonly adulterated and their common adulterants, and is



thus enabled to determine questions of identity and purity. Laboratory 2. II, 2.

(8) **Drug Analysis.**—This is chiefly a practical laboratory course in the analysis and standardization of the inorganic medicines, chemicals, organic drugs and preparations, according to the methods of the United States Pharmacopoeia. One recitation and two laboratory periods. I and II, 6.

(9) **Materia Medica, Thereapeutics and Toxicology.**—Lectures and recitations on the physical, physiological and therapeutic properties of medicines, together with their classification and dosage. Special attention is also given to methods of detection, antidotes and toxic posology of the more commonly used remedies. I, 4.

(10) **Prescription Reading and Dispensing.**—A technical study of all phases of the prescription, practical exercises at sight reading and in the art of extemporaneous compounding. I, 3.

(11) **Urine Analysis.**—Two credits per week devoted to the study and estimation of the constituents of urine in health and disease. II, 2.

(12) **Pharmacy Latin.**—An elementary course in Latin syntax, with a study of Latin pharmaceutical terms. I, 3.

The above subjects with the exception of (12) are listed in proper sequence, and those which precede are prerequisite for those which follow, according to the schedule of the two-year course.



# The Preparatory School

Miss Mary A. Cantwell, Principal.

The preparatory school is maintained for the benefit of the young people who live in counties not having high schools, or in the rural districts not convenient to the city high schools and for those who wish industrial training with their high school course. With the large and well equipped kitchen, sewing rooms, shops and laboratories, the work ranks with that of the best secondary industrial schools. Many members of the college faculty give preparatory instruction in their special subjects.

For admission to the preparatory school the equivalent of an eighth grade certificate is required. Those not having eighth grade certificates will pass an examination in the common branches, or otherwise satisfy the principal before entering classes.

Military drill is required of the boys and physical culture of the girls.

A liberal course of reading is given in the English classics as a part of the required work. It is desirable, so far as possible, for students to purchase the books and make them a part of their private libraries.

Judge F. K. Armstrong, of Bozeman, gives a prize of ten dollars to the one taking first place in an annual declamatory contest. There is also a prize of five dollars for the second best. Only regular students in the preparatory school are eligible to enter this contest.

Hon. Nelson Story, Jr., gives twenty-five dollars annually for prizes in a contest in extemporaneous speaking, open to preparatory students only. The plan of the contest is like that conducted for the high schools of the state in March. The contestants speak for from five to eight minutes on a subject selected by them some three hours before the time set for the contest, from a limited list prepared by a committee of the faculty.

Below are outlined three preparatory courses—the Scientific; and two industrial courses—Home Science and the Mechanic Arts. It will be noted that each of these courses includes the ten units required from all candidates for admission to college, as shown on page 15. For admission to college fifteen units of work are required; but the following courses, planned to occupy full four years, are based upon a minimum of sixteen units. A suitable diploma will be given upon the completion of any one of these courses.

A unit consists of work to the amount of four sixty-minute recitation periods per week for thirty-six weeks. Two periods of laboratory, shop work, home science, or drawing, shall count as one recitation period.

Irregular registration, except as necessitated by a student's previous work, is allowed by vote of the faculty only.

The courses in English, German, and Mathematics may be taken only in the order prescribed in the description of the work.

**SCIENTIFIC COURSE.****FIRST YEAR.**

First Semester.			
English Composition (a).....	4	English Composition (a).....	4
Algebra (a).....	4	Algebra (a).....	4
Greek History (a).....	4	Roman History (a).....	1
Freehand Drawing (a).....	2	Freehand Drawing (a).....	2
Forge work (b) or Sewing (a)....	2	Forge work (b) or Sewing (a)....	2

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16—  
16**SECOND YEAR.**

Rhetoric (b) .....	4	Rhetoric (b) .....	4
Algebra (b) .....	4	Plane Geometry (c).....	4
Medieval History (b).....	4	Modern History (b).....	4
Biology (a) .....	2	Biology (a) .....	2
Freehand Drawing (b).....	2	Freehand Drawing (b).....	2

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17—  
17**THIRD YEAR.**

Literature (c) .....	4	Literature (c).....	4
Plane Geometry (c) .....	4	Solid Geometry (d).....	4
German (a) .....	4	German (a) .....	4
Elective .....	4	Elective .....	4

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16—  
16**FOURTH YEAR.**

Literature (d).....	4	Literature (d) .....	4
Trigonometry (Math. 2a).....	3	Physiology (b).....	3
German (b) .....	4	German (b) .....	4
Physics (a) .....	4	Physics (a) .....	4
Elective .....	3	Elective .....	3

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18—  
18

## HOME SCIENCE COURSE.

## FIRST YEAR.

First Semester.		Second Semester.	
English Composition (a).....	4	English Composition (a).....	4
Algebra (a) .....	4	Algebra (a) .....	4
Greek History (a).....	4	Roman History (a).....	4
Freehand Drawing (a).....	2	Freehand Drawing (a).....	2
Sewing (a) .....	2	Sewing (a).....	2
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16		16	

## SECOND YEAR.

Rhetoric (b) .....	4	Rhetoric (b) .....	4
Algebra (b) .....	4	Plane Geometry (c).....	4
Biology (a) .....	3	Biology (a) .....	3
Freehand Drawing (b).....	2	Freehand Drawing (b).....	2
Cooking (g).....	4	Cooking (g).....	4
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17		17	

## THIRD YEAR.

Literature (c) .....	4	Literature (c) .....	4
Plane Geometry (c).....	4	Solid Geometry (d).....	4
German (a) .....	4	German (a) .....	4
Textiles (c) .....	2	Dressmaking (b) .....	4
The House (i).....	2		
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16		16	

## FOURTH YEAR.

Literature (d) .....	4	Literature (d) .....	4
Trigonometry (Math. 2a).....	3	Physiology (b) .....	3
German (b) .....	4	German (b) .....	4
Cooking (h).....	2	Household Management (j)).....	2
Physics (a) .....	4	Physics (a) .....	4
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17		17	

## MECHANIC ARTS COURSE.

## FIRST YEAR.

First Semester.		Second Semester.	
English Composition (a).....	4	English Composition (a).....	4
Algebra (a) .....	4	Algebra (a) .....	4
Greek History (a).....	4	Roman History (a).....	4
Freehand Drawing (a).....	2	Freehand Drawing (a).....	2
Mechanical Drawing (a).....	2	Mechanical Drawing (a).....	2
Forge Work (b).....	2	Forge Work (b).....	2
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18		18	

## SECOND YEAR.

Rhetoric (b) .....	4	Rhetoric (b) .....	4
Algebra (b) .....	4	Plane Geometry (c) .....	4
Medieval History (b).....	4	Modern History (b).....	4
Mechanical Drawing (b).....	2	Mechanical Drawing (b).....	2
Wood Work (a).....	2	Wood Work (a).....	2
Foundry (d) .....	2	Foundry (d) .....	2
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18		18	

## THIRD YEAR.

Literature (c) .....	4	Literature (c) .....	4
Plane Geometry (c).....	4	Solid Geometry (d) .....	4
German (a) .....	4	German (a) .....	4
Mechanical Drawing (c).....	3	Machine Work (f) .....	2
Machine Work (f).....	2	Pattern Making (e).....	1
Pattern Making (c).....	1	<hr/>	
18		18	

## FOURTH YEAR.

English (d) .....	4	English (d) .....	4
German (b) .....	4	German (d) .....	4
Physics (a) .....	4	Physics (a) .....	4
Mechanical Drawing (d).....	2	Mechanical Drawing (d).....	2
Elective .....	3 or 5	Elective.....	3 or 5
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17 or 19		17 or 19	

## Electives.

Machine Work (h).....	2
Steam Boilers .....	3
Electrical Practice .....	3
Trigonometry (Math. 2a).....	3

## Electives.

Machine Work (h).....	2
Steam and Gas Engines (b).....	3
Electrical Practice (a).....	3
Physiology (b) .....	3

**DESCRIPTION OF PREPARATORY WORK.****ENGLISH.**

(a) **English Composition.**—The aim of the course is to secure accurate and effective expression, and to afford constant exercise in composition. In connection with this work English classics will be made the subject of class room study, forming a basis for the study of literature. I and II. 1 unit. M. T. W. Th., 1 to 2.

(b) **Rhetoric.**—This is a continuation of course (a). Each student is required to do considerable written work beside work in the text book. I and II. 1 unit. M. T. Th. F., 10 to 11.

(c) **Literature.**—The object of this course is to develop an intelligent appreciation of American and English masterpieces and to promote a taste for the best literature. A series of classics similar in number and kind to the New English College requirements are the material for critical class room study. The student will find in the library valuable works of reference. Some written work will be required. I and II. 1 unit. M. T. W. Th., 11 to 12.

(d) **Critical Study.**—The purpose of this course is to apply the principles as laid down in composition and rhetoric. It will consist of a study of the classics, writing of themes, oral discussions and library and home reading assignments. I and II. 1 unit. M. T. W. Th., 1 to 2.

The following works are studied in class: Shakespeare's Merchant of Venice, and Macbeth; the Sir Roger de Coverley Papers from the Spectator; Irving's Life of Goldsmith; Coleridge's Ancient Mariner; Scott's Ivanhoe, and the Lady of the Lake; Tennyson's Gareth and Lynette, Lancelot and Elaine, and the Passing of Arthur; Lowell's Vision of Sir Launfal; and George Eliot's Silas Marner.

**MATHEMATICS.**

(a) **Algebra.**—This includes the following subjects: Addition, subtraction, multiplication, division, equations of the first degree with one unknown number, simultaneous equations of the first degree, factors, highest common factor, lowest common multiple, quadratic equations, simultaneous equations above the first degree, theory of indices (positive, negative, fractional, and zero), and radicals. I and II. 1 unit. M. W. Th. F., 10 to 11.

(b) **Advanced Algebra.**—Simultaneous quadratic equations; ratio proportion and variation; graphical representation of simple relations between two variables; arithmetical and geometrical progressions; binomial theorem for positive integral exponents; logarithms, including use of tables in simple numerical work. I.  $\frac{1}{2}$  unit. M. T. W. F., 9 to 10.

(c) **Plane Geometry.**—This includes, in addition to the work given in the standard texts, a large number of original exercises. Prerequisite: Algebra (a). II, 1. 1 unit. M. T. W. F., 9 to 10. M. T. W. Th., 1 to 2.



(d) **Solid Geometry.**—In this course special attention is given to the geometry of the sphere. Prerequisite: Algebra (a) and (b) and geometry (c). II.  $\frac{1}{2}$  unit. M. T. W. Th., 1 to 2.

### SCIENCE.

(a) **Elementary Physics.**—Lectures with experimental illustrations, recitations, assigned problems, and laboratory work four hours per week throughout the year, in mechanics, sound, heat, light, electricity and magnetism. Text book: A First Course in Physics. by Millikan & Gale. I and II 1 unit. M. W. F., 9 to 10; F., 1 to 3.

(a) **Biology.**—This course will be conducted in such manner as to give the pupils a good understanding of the first principles of the science of living things. While the subjects of the course will be taken from the field of zoology and botany, it is not the purpose to train zoologists and botanists, but to equip the pupils, by the information and training given, to observe and interpret simple biological facts. Recitations and laboratory exercises. I and II.  $\frac{3}{4}$  unit. I, M. W., 8 to 9; W., 2 to 4. II, M. W., 8 to 9; Th., 2 to 4.

(b) **Elementary Physiology.**—An elementary course in physiology covering the main facts of general anatomy and physiology of the human body. Nutrition, the blood and circulation, respiration, excretion, nervous system and its functions, and the special senses are among the topics covered. II.  $\frac{1}{2}$  unit. M. T. F., 8 to 9.

### GERMAN.

(a) **Beginning German.**—The work of the first year includes pronunciation, grammar, selections in prose and verse with practice in speaking and writing German. I and II. 1 unit.

(b) **Second Year German.**—Texts suitable for second year work; for the most part, the writings of contemporary authors. Memorizing of easy colloquial sentences and poems. Conversation and composition. I and II. 1 unit.

### HISTORY.

(a) **Greek and Roman History.**—The mastery of such a text as West's Ancient World or a briefer text on Greek and Roman history. Special attention is paid to the geography of the ancient world, and references to other books and occasional outside topics given to enable the students to grasp the subject rather than memorize the text. When possible, pictures of places or of objects of study are used. I and II. 1 unit. M. T. W. F., 9 to 10.

(b) **Medieval and Modern History.**—The second year is given to medieval and modern history, using the same methods. I and II. 1 unit. M. T. W. Th., 11 to 12.

### DRAWING.

(a) **Drawing.**—Freehand drawing from geometric solids and casts. Study of light and shade. Object drawing, in charcoal, pencil, and pen and ink. Study of linear perspective with practical exercises in per-

spective sketching. I and II.  $\frac{1}{2}$  unit. M. W., 1 to 3.

(b) **Continuation of Course (a).**—Study of design and handicraft at discretion of instructors. I and II.  $\frac{1}{2}$  unit. M., 2 to 4; Th., 8 to 10.

### HOME SCIENCE.

(a) **Sewing.**—The fundamental principles of hand and machine sewing applied to the making of aprons and undergarments—students provide suitable materials. The finished work is the property of the student. I and II.  $\frac{1}{2}$  unit. F., 10 to 11; Th., 8 to 10.

(b) **Dressmaking.**—Designing, cutting and making simple dresses is a part of the work. I and II.  $\frac{1}{2}$  unit. T. Th., 8 to 10.

(c) **Textiles.**—A study of cotton, wool, silk and linen in regard to its microscopical structure, physical properties, manner of growth, and manufacture into cloth. Simple tests for adulteration are discussed. Sample note book is kept. I.  $\frac{1}{4}$  unit.

(g) **Cooking.**—The object of the course is to teach plain cooking breads, meats, eggs, cereals, soups, salads, preserving fruits, cakes, candy and simple desserts. Some attention is given to invalid cookery. Visits to the meat market to study cuts of meat. The students are shown how biology and chemistry apply to the preparation of foods. Williams and Fisher's text book, *The Elements of the Theory and Practice of Cookery*, is used. Lecture, 2; laboratory, 2. I and II, 1 unit.

(h) **Cooking.**—A continuation of course (g). Attention is given to table setting and the preparation of meals. I,  $\frac{1}{4}$  unit.

(i) **The House.**—A study of the evolution of the house; the surroundings, situation and plan of the house, heating, lighting, plumbing and drainage. Lectures on house furnishings, exercises in making skeleton plans of small houses. The text book used is *The House*, by Miss Bevier. I,  $\frac{1}{4}$  unit.

(j) **Household Management.**—This course deals with the organization of the household, expenditure of income, and the planning and selection of equipment and furnishings of the house. II.  $\frac{1}{4}$  unit. M. W., 8 to 9.

### MECHANICAL DRAWING AND DESIGN.

Before beginning work, a student must provide himself with one of the following sets of drawing instruments or a set of equal quality: K. & E. No. 896 NCP with No. 523 $\frac{1}{2}$  pen or Dietzgen No. 937 C with No. 508 pen.

(a) **Mechanical Drawing.**—Lettering. The shape and proportions of letters, freehand construction. Freehand sketching of simple machine parts, reproduced in detailed working drawings. Orthographic projection in the third quadrant. I and II.  $\frac{1}{2}$  unit. T., 10 to 12; Th., 8 to 10.

(c) **Mechanical Drawing.**—The elementary principles of the kinematics of machinery with such applications as to be of immediate utility in shop practice; the study of gears, screws, cams, bearings and quick-return mechanism. One hour lecture, four hours drawing per week. I and II.  $\frac{3}{8}$  unit. W. Th., 2 to 4; Sat., 8 to 10.

(d) **Mechanism.**—A continuation of (c) in the study of bevel gears, gearing in train, roller bearings, belts and pulleys, rope and chain drive, together with tests of the strength of various materials. Recitation, four hours drawing per week. I and II,  $\frac{1}{2}$  unit.

### SHOP WORK.

(a) **Wood Work.**—Joinery, consisting of a series of exercises designed to develop skill in the use and care of bench tools, and proficiency in reading simple working drawings. Turning, comprising spindle, face plate and chuck work in the manufacture of simple patterns and standard articles for shop use. House carpentry, illustrating the methods and principles of framing, rafter and stair cutting, mill work and finishing. Cabinet work, in which standard wood shop machinery is used in the manufacture of drawing tables, book and filing cases, office desks and other plain furniture, and including finishing in oil, stain, wax and varnish. Taken with mechanical drawing (b). I and II.  $\frac{1}{2}$  unit. M. W., 2 to 4.

(b) **Forge Work.**—The operation of hand and power forges and manipulation of the fire, with progressive exercises in iron forging designed to teach the operations of drawing, upsetting, bending, forming and welding. The work of the second semester includes the forging and welding of mild and tool steels, as well as the hardening and tempering of simple hand tools, lathe tools, foundry tools, springs, etc., with annealing and case-hardening. With mechanical drawing (a). I and II.  $\frac{1}{2}$  unit. T. Th., 8 to 10.

(d) **Foundry.**—A course in bench and floor moulding in green sand. Castings in white metal, brass and cast iron are poured for use in the machine shop. With mechanical drawing (b). I and II.  $\frac{1}{2}$  unit. I, T., 2 to 4; Sat., 10 to 12. II, F., 1 to 3; Sat., 10 to 12.

(e) **Pattern Making.**—Instruction in the methods of making proper allowances on patterns for draft, shrinkage and finish, and practice in the construction of patterns for pulleys, hangers, machine parts and pipe fittings, with the necessary core boxes. II.  $\frac{1}{4}$  unit. T., 2 to 4; Sat., 8 to 10.

(f) **Machine Work.**—Bench work, including chipping, filing, scraping, fitting, soldering, brazing, and babbitting. Machine tool work on drill press, shaper, planer and lathe. II.  $\frac{1}{4}$  unit.

(h) **Machine Work.**—Students choosing this subject are given advanced work on lathe, milling machine and grinder, with practice in hardening and tempering taps, dies, cutters and high speed steels. I and II.  $\frac{1}{2}$  unit. T. Th., 8 to 10.

### STEAM BOILERS AND ENGINES.

(a) **Steam Boilers and Practice.**—The construction and operation of steam boilers, and their auxiliaries, including the care of boilers, their strength and evaporative capacity, the physical properties of steam, combustion of fuel, pumps, injectors, feed water heaters, condensers. Pre-

requisites: Solid geometry, mechanical drawing (a), (b), and machine work (f). I.  $\frac{3}{8}$  unit. Two lectures, one laboratory.

(b) **Steam and Gasoline Engines.**—The construction and operation of steam and gasoline engines; valves and valve gears, governors; lubricators; indicator cards, indicated horse power, brake horse power, efficiency; belts and pulleys. Prerequisite: Steam boilers (a). II.  $\frac{3}{8}$  unit. Lectures, 2; laboratory, 1.

### ELECTRICAL PRACTICE.

(a) **Electrical Practice.**—Elementary principles of electricity, electric wiring, management and care of electrical machines and apparatus, including dynamos and motors, batteries, electric lights, telephones and telegraph apparatus. Text book: Management of Electrical Machines, by Crocker and Wheeler. Three lectures and recitations per week. I and II.  $\frac{1}{4}$  unit.

### COURSE IN HOUSEHOLD ECONOMY.

#### One Year.

This course is intended for young women who are not prepared to do college work but who wish systematic instruction in home science. Applicants must have completed the eighth grade in the common schools. High school graduates should not enroll for this course.

#### First Semester.

Physical training.....	1
Sewing (d).....	3
Art .....	2
Cooking (g) .....	4
The House (i).....	2
Textiles (c) .....	2
Elective .....	4

#### Second Semester.

Physical training .....	1
Household Management (j).....	2
Sewing (d).....	4
Home Decoration.....	1
Cooking (g).....	4
Handicraft .....	2
Elective .....	4

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Note.—Electives are to be chosen from English, music, art, or modern language. See preparatory school for sub-courses in English, the house, household management and textiles.

(g) **Cooking.**—The object of the course is to teach plain cooking breads, meats, eggs, cereals, soups, salads, preserving fruits, cakes, candy and simple desserts. Some attention is given to invalid cookery. Visits to the meat market to study cuts of meat. The work is theoretical as well as practical. The students are shown how biology and chemistry apply to the preparation of foods. Williams' and Fisher's text book, "The Elements of the Theory and Practice of Cookery," is used. I and II, 8.

(d) **Sewing.**—The fundamental principles of hand and machine sewing, applied to aprons and undergarments, are given in the first semester. In the second semester, designing and making waists and simple dresses. A wool dress and a dress for afternoon wear are part of the work. I and II.



## School of Agriculture

The School of Agriculture has for its specific purpose the training of the younger generation in such a way that the term 'farming' will mean a pleasure and a profitable source of income rather than the much dreaded drudgery as thought of at present. Much of the instruction is of a practical nature and the student is brought into actual contact with the problems connected with farm life.

The course extends through three years of six months each and comes in the winter season when the young people can be spared from farm work. For entrance to this course, students must have passed the eighth grade or its equivalent, otherwise they shall be required to pass an entrance examination or give satisfactory evidence to the agricultural committee that they are capable of carrying on the work. Young men 21 years of age and over will be admitted to the course without having completed the eighth grade in the public school, provided they have had some practical experience upon the farm and possess a fair common school education. Those who satisfactorily complete the course will be given diplomas.

A general fee of \$6.00 is charged all students upon entering the course. This fee is not returnable unless students are honorably dismissed early in the year on account of sickness or other reason satisfactory to the faculty. A laboratory fee of \$2.00 is required in dairying, \$2.00 in chemistry and \$1.00 in biology. The shop deposit is \$4.00 per year in woodworking, and \$6.00 per year in blacksmithing.

In several of the courses these deposits are made to insure against breakage of equipment by the students taking the work, and the careful student is able to secure a return of at least a part of his deposit when he completes the course.

The total cost to the student will be about \$150 to \$175. This will include board, room, text books, etc.

Students in this course have the privilege of studying a modern dairy in operation, including types of the best breeds of dairy cattle; a complete poultry plant, containing breeds illustrating especially the best laying strains and market fowls; modern grain and soil laboratories; model farm buildings and barns, with pure bred live stock; the experiment station farm, greenhouses and orchards; the large biological, chemical and physical laboratories; and the well equipped wood and iron shops of the engineering department. The methods employed are practical. The instruction is supplemented with practice in the laboratories, the dairy, the orchards, the greenhouses, and with the herds. As far as practicable, visits are also made to other farms and herds in the neighborhood.

The variety of animals included upon the farm affords ample opportunity to see the various diseases, injuries, etc., encountered in farm animals. In the veterinary building there is provided a clinic room, where sick and injured animals are treated, and the student is given the benefit of these demonstrations.



## COURSE IN SCHOOL OF AGRICULTURE.

## FIRST YEAR.

First Semester.		Second Semester.	
English Composition (Eng. f).....	2	English Composition (Eng. f).....	2
Animal Types (An. Ind. a).....	2	Animal Types (An. Ind. b).....	2
Nursery Practice (Hort. a).....	3	Poultry (And. Ind. e).....	4
Farm Dairy (An. Ind. f).....	4	Vegetable Gardening (Hort. b)....	3
Physics (Phys. b).....	5	Chemistry (Chem. a).....	5
Carpentry (Mech. Arts a).....	4	Blacksmithing (Mech. Arts b)....	4
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## SECOND YEAR.

Rhetoric (Eng. g).....	2	Rhetoric (Eng. g).....	2
Breed Types (An. Ind. c).....	3	Breed Types (An. Ind. d).....	3
Orcharding (Hort. c).....	3	Irrigation and Drainage	
Botany (Biol. b).....	4	(Agron. g) .....	2
Farm Machinery (Agron. f).....	4	Entomology (Biol. d).....	4
Field Crops (Agron. a).....	4	Plant Diseases (Biol. c).....	4
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## THIRD YEAR.

Literature (Eng. h).....	2	Literature (Eng. h).....	2
Feeding and Management of		Feeding and Management of	
Live Stock (An. Ind. g).....	3	Live Stock (An. Ind. h).....	3
Landscape Gardening (Hort. c) 3		Dairy Manufacture (An. Ind. j) 3	
Soil Physics (Agron. c).....	3	Soil Fertility (Agron. d).....	3
Principles of Breeding		Farm Management (Agron. e)....	3
(An. Ind. i).....	3	Common Diseases (Vet. Sci. a)....	3
Common Diseases (Vet. Sci. a)....	3	Traction Engineering (Agron. j) 3	
Grain Judging (Agron. b).....	2	<hr/>	
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### AGRONOMY.

(a) **Field Crops.**—This course includes a study of the methods of growing and producing oats, wheat, flax, rye and corn. First semester, 4 credits, 3 lectures, 1 laboratory. Prerequisite: Biology (b).

(b) **Field Crops.**—This includes a study of all forage crops and grasses. Second semester, 4 credits, 3 lectures and 1 laboratory. Prerequisites: Biology (c) and agronomy (a).

(c) **Soil Physics.**—A review of the study of the formation of soils and a study of the methods of maintaining the physical condition of the soil. First semester, 3 credits, 3 lectures. Prerequisite: Physics (b), chemistry (a) and agronomy (b).

(d) **Soil Fertility.**—Soil fertility includes a study of the methods of maintaining the fertility of the soil, especially in this state, as well as a study of the different methods of handling the farm yard manure and the rotation of crops. Second semester, 3 credits. Prerequisites: Agronomy (c), chemistry (a) and agronomy (b).

(e) **Farm Management.**—In this course students are taught the practical methods of managing a farm. Second semester, 3 credits. Prerequisite: Agronomy (c).

(f) **Farm Machinery.**—This course includes a study of the various types of farm machinery. Special emphasis is laid on the selection, adjustment and care of farm machinery. The course will also include instruction on the modern farm conveniences, such as telephone, water supply systems, etc. Prerequisite: Physics. 4 credits, first semester, second year.

(g) **Irrigation and Drainage.**—Includes a study of the different methods of irrigating and draining the land. Second semester, 2 credits. Prerequisite: Physics (b).

(h) **Grain Judging.**—In this course students are given practical work in judging the different grains. First semester, 2 credits, 2 laboratories. Prerequisites: Agronomy (a) and (b).

(i) **Traction Engineering.**—This course takes up the various forms of farm motors. Special attention is given to the operation of traction engines. The course is designed to enable the students to operate both steam and gasoline engines intelligently and at minimum expense. Prerequisites: Physics, agronomy (f). 3 credits, second semester of third year.

### ANIMAL INDUSTRY.

(a) **Animal Types.**—A study of the market types of cattle and sheep. First semester, 2 credits, 2 laboratories.

(b) **Animal Types.**—Judging of the market types of dairy cattle, horses and swine. Second semester, 2 credits, 2 laboratories.

(c) **Breed Types.**—Includes a study of the breed types of cattle and sheep. First semester, 3 credits, 1 lecture and 2 laboratories. Prerequisites: Animal industry (a) or (b).

(d) **Breed Types.**—Includes a study of the breed types of dairy cat-

tle, horses and swine. Second semester, 3 credits, 1 lecture and 2 laboratories. Prerequisite: Animal industry (a) or (b).

(e) **Poultry.**—This course includes a study of the breed types and the management of poultry. Second semester, 4 credits, 2 lectures and 2 laboratories.

(f) **Farm Dairying.**—Includes a study of the methods of handling cream and butter upon a small dairy farm. First semester, 4 credits, 2 lectures and 2 laboratories.

(g) **Feeding and Management of Live Stock.**—In this course the students receive instruction as to the different methods of feeding and managing cattle and sheep. They are also taught the different methods by which these animals are prepared for the show ring. First semester, 3 credits, 2 lectures and 1 laboratory. Prerequisites: Animal industry (c) and (d).

(h) **Feeding and Management of Live Stock.**—A study of the methods of feeding, showing and managing horses and hogs. Second semester, 3 credits, 1 lecture and 2 laboratories. Prerequisites: Animal industry (c) and (d).

(i) **Principles of Breeding.**—This course includes a study of the principles of breeding as directly applied to the farm. Cross breeding, inbreeding and line breeding are taken up. First semester, 3 credits. Prerequisite: Animal industry (c) and (d).

(j) **Dairy Manufacture.**—This course includes a study of the creamery methods of making butter and cheese. Second semester, 3 credits, 1 lecture and 2 laboratories. Prerequisite: Animal industry (f).

### VETERINARY SCIENCE.

(a) **Common Diseases.**—The aim in this course is to first give the student lectures upon the physiology of the digestive, respiratory and blood vascular systems in order to prepare him for a more comprehensive study of the common diseases. It also includes a study of the various kinds of wounds and their treatment, general conformation and care of the teeth and some of the more common ailments in all species of domestic animals. During the second semester, lectures will be given on the care and handling of breeding animals and accidents and disease attendant upon parturition. 3 credits each semester.

### HORTICULTURE.

(a) **Nursery Practice.**—This study deals with the propagation of fruit and ornamental plants for both home and orchard purposes. First semester, 3 credits.

(b) **Vegetable Gardening.**—This course takes up a study of the methods of growing vegetables, hot bed construction and management, and the different methods of gathering and marketing vegetables and fruits. Second semester, 3 credits.

(c) **Orcharding.**—Methods of growing and handling trees and small fruits are studied. First semester, 3 credits. Prerequisite: Horticulture (a) or (b).

(d) **Landscape Gardening.**—In this course particular attention is

given to the study of plans for laying out and mapping farm homes, as well as to a study of the different trees, shrubs and flowering plants that are suitable for Montana. First semester, 3 credits. Prerequisites: Horticulture (a) or (b).

### BIOLOGY.

(b) **Botany.**—The elements of botany are taken up, especially with a view to the needs of agricultural students. The classification, structure, physiology and ecology of plants, are briefly covered. Special attention is given to farm weeds. First semester, 4 credits, 3 lectures, and 1 laboratory.

(c) **Plant Diseases.**—Special attention is given to the recognition of the more important diseases of cultivated plants and the methods of controlling them. This work is conducted upon a scientific basis, but at all times the needs of the practical agriculturalist are kept in view. Second semester, 4 credits, 2 lectures and 2 laboratories.

(d) **Entomology.**—After a very brief survey of the animal kingdom, the anatomy, physiology, habits, transformations, and classification of insects are studied, together with the methods for controlling injurious species. This course is designed, in a comprehensive manner, to prepare the student for defense against the various insect pests of the farm, orchard and garden. Second semester, 4 credits, 3 lectures and 1 laboratory.

### PHYSICS.

(b) **Elementary Physics.**—Includes experimental lectures, recitations and assigned problems on mechanics, heat, light and electricity. Emphasis will be placed upon those subjects that have a direct bearing on applied agriculture. First semester, 5 credits.

### CHEMISTRY.

(a) **Elementary Chemistry.**—Includes a study of the fundamental principles of chemistry and their relation to agriculture. Second semester, 5 credits.

### MECHANIC ARTS.

(a) **Carpentry.**—The use and care of carpentry tools. A series of exercises in joinery, followed by practice in framing and rafter and stair cutting. First semester, 4 credits, 4 laboratories.

(b) **Blacksmithing.**—Care and manipulation of fire, iron forging, including the operation of drawing, upsetting, pointing, bending, welding, calculation of stock; implement repairs, plow pointing, manufacture of chains, hooks, clevises, clips, etc. Second semester, 4 credits, 4 laboratories.

### ENGLISH.

(f) **English Composition.**—The first year is devoted largely to practice in the simpler forms of composition, letter writing, simple narrative and exposition; and considerable time is given to reading aloud, black-board work and informal discussion, with attention to correct speech. First and second semesters; 2 credits each semester.

(g) **Rhetoric.**—During the second year more advanced work is given in composition, with frequent themes, reviews, etc. A few masterpieces are read as a basis for a careful study of good style. First and second semesters; 2 credits each semester.

(h) **Literature.**—During this year a more systematic study of several authors is attempted. For the year 1912-1913 the time will be given to Irving, Hawthorne, Emerson and Longfellow. A considerable amount of writing in several different forms is required. First and second semesters; 2 credits each semester.

## Winter Short Courses

January 27 to February 8, 1913.

### FARMERS' SHORT COURSES.

**Week January 27 to February 1.**—Special work on horses. Feeding, improvement and care of horses. Diseases of the horse, with clinics. Judging horses. In addition to the regular teachers in animal industry and veterinary science, horse specialists from outside will give instruction.

**Week February 3 to 8.**—Special work on cattle, sheep and swine. A study of feeding and breeding, together with common diseases, care and management and stock judging.

### HOUSEKEEPERS' SHORT COURSES.

**Week January 27 to February 1.**—Instruction in cooking and sanitation with special lectures in food and clothing. There will also be special work in home decoration, landscape gardening, the fly and other insect pests, and emergency treatment for accident and disease.

**Week February 3 to 8.**—Work for women in dairying, care and management of poultry, gardening and orcharding.

### GENERAL LECTURES.

During the entire two weeks lectures will be given along special lines by the departments of soil and field crops, horticulture and dairying. Evening lectures and entertainments will be given in the college assembly room.



# Alumni

## With their Years, Degrees and Present Addresses and Occupations.

- Allen, Elbert, B. S., 1903; Attorney at Law, Livingston, Mont.
- Alward, Mary L., B. S., 1908; Teacher in Gallatin County High School, Bozeman, Montana.
- Annin, James T., B. S., 1911; Business, Columbus, Montana.
- Baker, Harold E., B. E. E., 1907; Superintendent Butte Sub-station, Missouri River Power Co., Butte, Mont.
- Bancroft Raymond E., B. S., 1911; Fruit and Orchard Inspector, Billings, --cnt.
- Barnard, Robert B., B. S., 1910; Westinghouse Electric Co., Pittsburg, Pa.
- Bell, James C., B. S., 1911; Superintendent of Fruit Farm, Bitter Root Valley, Darby, Mont.
- Benton, Ralph, B. S., 1906; Instructor in Entomology, College of Agriculture, University of California, and Assistant Entomologist in charge of Apiculture, California Experiment Station, Berkeley, Calif.
- Bole, William S., B. S., 1906; Physician and County Health Officer of Cascade Co., Great Falls, Mont.
- Booker, Clinton T., B. S., 1911; Butte Electric and Power Co., Butte, Mont.
- Blankenship, E. V., B. S., 1897; Farming and Stock Raising, Bozeman, Mont.
- Brewer, Lucile, B. S., 1909; Matron, Woman's Hall, Montana State University, Missoula, Mont.
- Breneman, Annie T., B. S., Teacher in Eighth Grade, Bozeman, Mont.
- Brown, Archie S., B. S., 1910; Electrical Expert, Bremerton Navy Yards, Bremerton, Wash.
- Brown, Edith E., B. S., 1904; Mrs. John Milloy, Regina, Canada.
- Bull, Edna, B. S., 1909; Mrs. W. G. Kirscher, Townsend, Montana.
- Bull, Frieda M., B. S., 1907; M. S., 1909; Instructor in Mathematics, Montana State College, Bozeman, Mont.
- Burke, Edmund, B. S., 1907; Chemist and Meteorologist of the Montana Agricultural Experiment Station, Bozeman, Mont.
- Butter, Donald, B. S., 1909; Electrical Engineer, Washington Water Power Co., Spokane, Wash.
- Caldwell, Thomas O., B. A. C., 1899; Leasing on Gold Reef and Maginnis Mine, Gilt Edge, Mont.
- Carr, Irene H., B. S., 1911; Mrs. Claude Meserve, Bozeman, Mont.
- Carmichael, Effie, B. S., 1910; Instructor in Home Science in Public Schools, Lewistown, Mont.
- Chaffee, Sarah, B. S., 1906; Mrs. Rudolph Beseke, Rathdrum, Idaho.
- Clark, Ben A., B. S., 1911; Farmer, Springdale, Mont.
- Clark, Grace, B. S., 1911; Instructor in Home Science in a Girl's Mission School, Old Umtali, Rhodesia, Africa.

- Cockrill, Irvin, B. A. C., 1900; Osteopath Physician, New York City.
- Collins, Walter E., B. S., 1902; Trust Officer of State Savings Bank and Practicing Attorney, Butte, Mont.
- Cooke, Amy, B. S., 1908; Mrs. George Ambrose, Mackay, Idaho.
- Cowan, Lewis, B. C. E., 1904; Bozeman, Mont.
- Davidson, Mary E., B. S., 1910; Student in Deaconess Training School, Chicago, Ill.
- DeMuth, David R., B. S., 1910; First Assistant Engineer, Hebgen Dam, Norris, Mont.
- DeMuth, Maud S., B. S., 1907; Mrs. W. D. Tallman, Bozeman, Mont.
- Driscoll, William J., B. S., 1908; Civil Engineer, Lawrence, Mass.
- Edsall, William L., B. S., 1911; Westinghouse Electric Co., Pittsburg, Pa.
- Edwards, Timothy, B. S., 1909; Draughtsman, N. P. Office, Livingston, Mont.
- Ellis, Edward M., B. S., 1911; General Electric Co., Lynn, Mass.
- Fisher, Charles M., B. S., 1908; Electrical Engineer, Washington Water Power Co., Spokane, Washington.
- Fisher, Helen, B. S., 1910; Bozeman, Mont.
- Flager, Harold J., B. E. E., 1907; Electrical Engineer, Seattle Electric Co., Seattle, Washington.
- Flager, Howard A., B. E. E., 1906; Business, Mount Vernon, Wash.
- Flager, Ruth, B. S., 1910; Instructor in Sewing, Butte High School, Butte, Mont.
- Flaherty Charles, B. C. E., 1904; Civil Engineer, firm of Sacket & Flaherty, Livingston, Mont.
- Foster, Florence, B. S., 1896; Mrs. Burton Fleming, Iowa City, Iowa.
- Fox, Hazel, B. S., 1910; Teacher, Bozeman, Mont.
- Freeman, Beatrice, B. S., 1900; Mrs. Thomas S. Davis, Columbus, Mont.
- Freeman, W. B., B. C. E., 1903; Consulting Engineer, Denver, Colo.
- Froebe, Frank J., B. S., 1911; Local Representative of E. B. Clark Seed Co., Bozeman, Mont.
- Gardiner, Henry C., B. S. A., 1903; Veterinarian and Agricultural Expert, Anaconda Copper Mining Co., Anaconda, Mont.
- Gottschalk, Carl, B. S., 1909; M. E., 1910; Assistant in Chemistry, Bozeman, Montana.
- Griffith, Warren J., B. E. E., 1907; Ford, Idaho.
- Haines, Will T., B. S., 1911; Instructor in Electrical Engineering and Graduate Student, Montana State College, Bozeman, Mont.
- Ham, Frank W., B. S., 1903; M. S., 1905; Professor of Physics, Montana State College, Bozeman, Mont.
- Hamilton, Everett A., B. S., 1911; Operator Madison River Power Co., Norris, Mont.
- Hartman, June, B. S., 1910; Student and Assistant Teacher in Albert La Bartag's School of Music, Chicago, Ill.
- Hartman, Lois K., B. S., 1907; Instructor in Domestic Science, University of Utah, Salt Lake City, Utah.

- Hartman, Will, B. S., 1908; Assistant to the Engineer in Charge, Northern Pacific R. R., Bozeman, Mont.
- Hawkins, P. H., M. S., 1903; Banker, Absarokee, Mont.
- Henderson, Charles F., B. S., 1910; Westinghouse Electric Co., Pittsburgh, Pa.
- Henderson, Lisle C., B. S., 1909; Switchboard Operator, Missouri River Power Co., Canyon Ferry, Montana.
- Higgins, Lucille, B. S., 1911; Assistant in Physics and Graduate Student, Montana State College.
- Hinds, Bert S., B. S., 1909; Superintendent Power Plant, Madison River Power Co., Norris, Mont.
- Hutton, Fred, B. E. E., 1902; Deceased.
- Jacobs, Lillian, B. S., 1910; Columbus, Mont.
- James, John S., B. S., 1909; Assistant Engineer, U. S. Reclamation Service, Valier Project, Conrad, Mont.
- Jones, Burle J., B. S., 1904; Manager Orangewood Nursery Co., Phoenix, Ariz.
- Jones, Wyatt Wagner, B. S., 1901; M. S., 1902; Plant Pathologist, Mammoth Copper Mining Co., Redding, Calif.
- Kennedy, Cyril C., Electrical Engineer with Madison River Power Co., Norris, Mont.
- Kimpton Addie, B. S., 1910; Radersburg, Mont.
- King, Lowell, B. S., 1904; Constructing Engineer, Electric Railway, Davenport, Iowa.
- King, Ruby E., B. S., 1909; Mrs. George Hogan, Bozeman, Mont.
- King, Willard V., B. S., 1911; Entomological Assistant, Bureau of Entomology, Dallas, Texas.
- Kinney, Edward D., B. C. E., 1907; Civil Engineer, Reclamation Service, Albuquerque, New Mexico.
- Kirk, Grace, B. S., 1911; Instructor in Domestic Science, Sweetgrass County High School, Big Timber, Mont.
- Kirk, Mary E., B. S., 1906; Mrs. Ermine Potter, Corvallis, Oregon.
- Kirscher, W. Guy, B. S., 1909; County Surveyor, Broadwater Co., Townsend, Mont.
- Koch, Eiers, B. S., 1901; Supervisor Forest Service, Missoula, Mont.
- Kremer, William J., B. S., 1910; Civil Engineer, Bozeman, Mont.
- Lamme, Maurice A., B. S., 1903; Director, Geology and Mineralogy, Government University, Montevideo, Uruguay, South America.
- Lewis, Edna, B. S., 1903; Instructor in Mathematics, Gallatin County High School, and Member County Board of Examiners, Bozeman, Mont.
- Livingston, Walter, B. S., 1910; Civil Engineer, Bozeman, Mont.
- Locke, Jerome G., B. C. E., 1908; C. E., 1910; Surveyor General of Montana, Helena, Mont.
- Lorentz, Flyod S., B. E. E., 1907; E. E., 1910; Electrical Engineer, United Missouri River Power Co., Keating Gold Mining Co., Radersburg, Mont.

- Maynard, Edna, B. S., 1900; M. S., 1903; Mrs. G. T. Morris, Bozeman, Mont.
- Metheny, Blanche, B. S., 1911; Supervisor of Domestic Art, Bozeman City Schools, Bozeman, Mont.
- Monforton, Zoe, B. S., 1901; Mrs. Dr. H. C. Patterson, Bozeman, Mont.
- Moore, Ellie J., B. S., 1901; Insurance Solicitor, Walla Walla, Wash.
- Morgan, O. P., B. S., 1896; Deceased.
- Morris, Elwood, B. S., 1909; Assistant Botanist and Bacteriologist, Montana Experiment Station, Bozeman, Mont.
- Morris, Garfield T., B. C. E., 1903; Civil Engineer, Bozeman, Mont.
- Mountjoy, Agnes, B. S., 1907; Teacher, Silver Star, Mont.
- Mountjoy, Irvin, B. E. E., 1908; Division Sales Manager, General Electric Co., Lafayette, Ind.
- Nash, Lewis, B. S., 1904; Farmer, Hardin, Montana.
- Noble, Erma, B. S., 1909; M. S., 1910; Teacher, Radersburg, Mont.
- Osborne, Belle, B. S., 1907; Mrs. D. E. Fish, Adel, Iowa.
- Pease, Jay L., B. C. E., 1907; Farmer, Bozeman, Mont.
- Peck, Harry L., B. S., 1911; Westinghouse Electric Co., Wilkesburg, Pa.
- Penwell, Clyde C., B. S., 1906; B. E. E., 1907; Belgrade, Mont.
- Penwell, Clyde W., B. E. E., 1909; Manager Independent Telephone Co., Larned, Kas.
- Peters, Orville S., B. S., 1909; Bureau of Standards, Washington, D. C.
- Peterson, James A., B. S., 1909; Political Writer, Minneapolis Tribune. Law Student, University of Minnesota, Minneapolis, Minn.
- Philpott, June, B. S., 1911; Graduate Student, Montana State College, Bozeman, Mont.
- Piedalue, Irene, B. S., 1911; Graduate Student, Montana State College, Bozeman, Mont.
- Pool, Louis K., B. S., 1910; City Engineer, Polson, Mont.
- Potter, Ermine L., B. S., 1906; Professor of Animal Husbandry, Oregon Agricultural College, Corvallis, Oregon.
- Quaw, Eugene C., B. S., 1911; Bozeman, Montana.
- Quaw, Lucille, B. S., 1903; Teacher in Public School, Sedan, Mont.
- Quaw, Mignon, B. S., 1902; Instructor, Gallatin County High School, Bozeman, Mont.
- Quaw, Thomas B., B. S., 1907; Business, Bozeman, Mont.
- Reese, Herbert J., B. S., 1904; Agent, Butte and Superior Copper Co., Bartlesville, Okla.
- Robinson, J. W., B. S., 1908; Benepe-Burglund Grain Co., Manhattan, Mont.
- Sacket, Charles T., B. C. E., 1904; C. E., 1907; Consulting Civil Engineer, San Diego, Calif.
- Sales, Reno H., B. S., 1898; Geologist, Anaconda Copper Co., Butte, Mont.
- Schabarker, W. W., B. M. E., 1902; Night Foreman, Shops Milwaukee R. R., Milwaukee, Wis.
- Schmidt, F. W., B. S., 1903; Superintendent Cyanide Plant, Xiririca, San Paulo, Brazil, S. A.

- Shaw, W. T., B. S., 1896; Unknown.
- Sloan, J. H., B. C. E., 1903; Public Service Commissioner, Madison, Wis.
- Sloan, W. F., B. E. E., 1903; Public Service Commissioner, Madison, Wis.
- Sloan, William Glen, B. S., 1910; Government Drainage Engineer, Boise, Idaho.
- Snider, Leta, B. S., 1911; Teacher, High School, Genessee, Idaho.
- Spain, Marvin, B. S., 1911; Bureau of Plant Industry, Washington, D. C.
- Spain, W. Whitfield, B. S., 1909; Manager Ranch, Gallop, Mont.
- Spragg, Frank A., B. S. A., 1902; Plant Breeder of Farm Crops for the Michigan Experiment Station, Lansing, Mich.
- Stafford, Lucy B., B. S., 1896; Mrs. Wm. Otis Peck, Pony, Mont.
- Tavener, Frank C., B. C. E., 1903; Construction Engineer, Montpelier, Idaho.
- Thompson, Homer C., B. S., 1902; Superintendent of Public Schools, Three Forks, Montana.
- Thorpe, Mabel A., B. S., 1907; Mrs. J. A. Thaler, Bozeman, Mont.
- Thorpe, Elizabeth, B. S., 1907; Teacher in Public Schools, Nephi, Utah.
- Tracy, Edna B., B. S., 1908; Teacher in High School, Virginia City, Mont.
- Tremper, Wm. G., B. S., 1911; U. S. Reclamation Service, St. Ignatius, Mont.
- Vreeland, Edna, B. S., 1909; Employment Secretary, Y. W. C. A., Spokane, Wash.
- Wade, Arthur M., B. S., 1911; Great Falls Power Co., Great Falls, Mont.
- Walchli, Fred E., B. S., 1910; Mechanical Engineer, Construction Work, Kalispell, Mont.
- Widener, Carl C., B. S., 1908; City Engineer, Bozeman, Mont.
- Williams, Frank B., B. M. E., 1899; Bozeman, Mont.
- Williams, Lee, B. E. E., 1902; County Surveyor, Powell County, and City Engineer, Deer Lodge, Mont.
- Williams, Roy B., B. S., 1911; U. S. Reclamation Service, St. Ignatius, Mont.
- Williams, Sidney A., B. S., 1911; Westinghouse Electric Co., Wilkesburg, Pa.
- Wilson, Elva A., B. S., 1909; Teacher, Public Schools, Bozeman, Mont.
- Wylie, Mary, B. S., 1910; North Yakima, Wash.

#### PHARMACY DEPARTMENT ALUMNI.

- Allen, Edgar Warren, Ph. C., 1910; Red Lodge Drug Co., (Joint Proprietor).
- Conard, Blanche, Ph. C., 1910; Gallatin Drug Co., Bozeman, Mont.
- Cox, Harvey H., Ph. C., 1910; Gallatin Drug Co., Bozeman, Mont.
- Crosby, Spencer J., Ph. C., 1911; Prescriptionist, Lapeyre Bros., Great Falls, Mont.
- Drinville, James, Ph. C., 1910; Kalispell Drug Co., Kalispell, Mont.
- Mitchell, Paul L., Ph. C., 1909; Proprietor Drug Store, Belfry, Mont.
- McCarthy, Ray, Ph. C., 1911; Mrs. E. H. Williams, Radersburg, Mont.
- Morris, Abbie F., Ph. C., 1911; Graduate Student, Bozeman, Mont.



Valentine, Charles P., Ph. C., 1910; Lapeyre Bros., Great Falls, Mont.  
 Young, Earl, Ph. C., 1910; J. A. Turner Drug Store, Huntley, Mont.

### SCHOOL OF MUSIC GRADUATES.

Alward, Coda, Piano, 1908.....	Polson
Bancroft, Alma J., Piano, 1911, Teacher.....	Bozeman
Benge, Faith, Piano, 1910.....	Winterset, Iowa
Brown, Edith, Piano, 1906, Mrs. John Milloy.....	Regina, Canada
Featherston, Ellis, Piano, 1907, Music Supervisor.....	Matteawan, N. Y.
Freeman, Lorraine, Piano, 1906, Student.....	Berlin, Germany
Griffin, Grace, Piano, 1907, Mrs. W. C. Blythe.....	Whittier, Cal.
Hartman, Flora, Piano, 1907, Teacher.....	Bozeman, Mont.
Hartman, June, Piano, 1910, Teacher and Student.....	Chicago, Ill.
Lovelace, Amy, Vocal, 1908, Teacher.....	Bozeman, Mont.
Maynard, Frances, Piano, 1909, Mrs. Ed. Howard.....	Bozeman, Mont.
Piedalue, Alice, Piano, 1908; Mrs. C. W. Hancock.....	Bozeman, Mont.
Stanton, Grace, Piano, 1901; Mrs. W. B. Walker.....	Bozeman, Mont.
Stanton, Grace, Piano, 1901; Mrs. W. B. Walker.....	Missoula, Mont.
Waters, Mary, Piano, 1902; Mrs. H. L. Houston, Teacher....	Helena, Mont.
Widener, Carl, Vocal, 1908, City Engineer.....	Bozeman, Mont.
Work, Vida, Piano, 1909, Teacher.....	Bozeman, Mont.

## Degrees Granted June, 1911

### BACHELOR OF SCIENCE.

Annin, James T.....	Agriculture
Bancroft, Raymond E.....	Agriculture
Bell, James C.....	Agriculture
Booker, Clinton T.....	Electrical Engineering
Carr, Irene H.....	Home Science
Clark, Ben A.....	Civil Engineering
Clark, Grace.....	Home Science
Edsall, William S.....	Electrical Engineering
Ellis, Edward M.....	Electrical Engineering
Froebe, Frank J.....	Civil Engineering
Haines, Will T.....	Electrical Engineering
Hamilton, Everett A.....	Electrical Engineering
Higgins, Lucille.....	Mathematics-Physics
King, Willard V.....	Biology
Kirk, Grace.....	Home Science
Metheny, Blanche.....	Home Science
Peck, Harry.....	Electrical Engineering
Philpott, June.....	Mathematics-Physics
Piedalue, Irene.....	Home Science
Quaw, Eugene C.....	History-Literature
Snider, Leta.....	Mathematics-Physics
Spain, Marvin J.....	Agriculture

Tremper William G.....	Civil Engineering
Wade, Arthur M.....	Electrical Engineering
Williams, Roy B.....	Civil Engineering
Williams, Sidney H.....	Electrical Engineering

**PHARMACEUTICAL CHEMIST.**

Crosby, Spencer J.....	White Sulphur Springs
McCarthy, Ray.....	Townsend
Morris, Florence A.....	Virginia City

**MUSIC.****DIPLOMA.**

Bancroft, Alma J.....	Piano	Bozeman
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**Names of Students 1911-12****POST GRADUATES.**

Bell, James C., B. S.....	Horticulture	Victor
Cheeley, Irvin E., D. V. M.....	Veterinary	Butte
Dockstader, Ernest A., A. B.....	Mathematics	Bozeman
Haines, Wm. T., B. S.....	Electrical Engineering	Laurin
Higgins, Lucille, B. S.....	Physics	Townsend
Kerper, George B., A. B.....	Agriculture	Cincinnati
Miller, Robert F., B. S. A.....	Mathematics	Bozeman
Mollet, Charles E., Ph. C.....	French	Bozeman
Philpott, June, B. S.....	Mathematics	Bozeman
Piedalue, Irene, B. S.....	Home Science	Bozeman

**SENIORS.**

Blessing, John.....	Horticulture	Brownsville, Minn.
Baker, Florence.....	History-Literature	Bozeman
Cook, George H.....	Horticulture	Como
Donaldson, Noble C.....	Agronomy	Helena
Daley, Freeman A.....	Civil Engineering	Chouteau
Draper, Charles H.....	History-Literature	Red Lodge
Dusenbery, Inez.....	History-Literature	Bozeman
Edwards, Margaret.....	Home Science	Great Falls
Hagerman, Edna.....	Home Science	Great Falls
Hinman, Ruth.....	History-Literature	Bozeman
Hodgskiss, John E.....	Agronomy	Chouteau
Jones, Kyle.....	History-Literature	Dupuyer
Lannin, Earl.....	Electrical Engineering	Missoula
Luther, J. Glenn.....	Electrical Engineering	Chouteau
McCraw, John L.....	Civil Engineering	Springfield, Mo.
Millegan, Guy J.....	Agronomy	Millegan
Morgan, George W.....	Agronomy	Bozeman
Morgan, Joseph D.....	Biology	Bozeman
Piedalue, Laura.....	Home Science	Bozeman
Shovell, William L.....	Horticulture	Hamilton
Taylor, John C.....	Agronomy	Chinook
Wolpert, Harold E.....	Civil Engineering	Boulder

**JUNIORS.**

Anderson, Lee B.....	Agronomy	Bozeman
Anderson, Ruth.....	Home Science	Bozeman
Alderson, Myrtle.....	History-Literature	Marysville
Atkins, Willard.....	History-Literature	Chicago, Ill.
Bole, Margaret.....	Mathematics-Physics	Bozeman

Blinn, George W.	Agronomy	Butte
Brabrook, Ralph S.	Civil Engineering	Indianapolis, Ind.
Brook, Thomas B.	Mechanical Engineering	Bozeman
Chambers, Edwin A.	Agriculture	Philadelphia, Pa.
Chapman, William E.	Civil Engineering	Dillon
Clark, Olive G.	Home Science	Hunter's Hot Springs
Douglas, Stanley	Electrical Engineering	Bozeman
Fisher, Wallace	Electrical Engineering	Bozeman
Gordon, Fred E.	Agronomy	Bozeman
Hartman, Ruth	Home Science	Bozeman
Hartman, Brooke	Mathematics-Physics	Bozeman
Hansen, Charles L.	Agronomy	Bozeman
Hill, Lewis L.	Civil Engineering	Livingston
Leinard, Ford B.	Agronomy	Bryan, Ohio
Mackay, Warren C.	Electrical Engineering	Anaconda
McGuire, J. Frank	Agriculture	White Sulphur Springs
Martin, Claude A.	Civil Engineering	Stockett
Morris, Ernest A.	Chemistry	Virginia City
Rubottom, Carter V.	Horticulture	Great Falls
Sackett, Nathalie F.	Civil Engineering	Bozeman
Seamans, Arthur E.	Agronomy	Wauwatosa, Wis.
Smith, M. Alda	Home Science	Dillon
Soper, Joseph R.	Horticulture	Bozeman
Truman, Joseph K.	Electrical Engineering	Bozeman
Wharton, John C.	Agronomy	Butte
Willey, LeRoy C.	Agronomy	Briston
Willson, Walter G.	Electrical Engineering	Bozeman
Wylie, Lawrence	Electrical Engineering	Bozeman

## SOPHOMORES.

Busse, Carl E.	Civil Engineering	Great Falls
Clark, Roy	Agriculture	Chinook
Crouch, Leslie B.	Agriculture	Bozeman
Cullum, Georgia	Home Science	Helena
Dissley, Frederick	Agriculture	Sugar Creek, Ohio
Davis, Horace S.	History-Literature	Bozeman
Dietz, Harry F.	Biology	Indianapolis, Ind.
Eckles, Mildred	Home Science	Forsyth
Everett, Inez	Home Science	Big Timber
Flanders, Clara	Home Science	Bozeman
Fowler, Viola	History-Literature	Bozeman
Grimes, Walter W.	Civil Engineering	Bozeman
Harmon, Ella	Home Science	Helena
Heighton, Pearl	Home Science	Chouteau
Higbie, David V.	Civil Eng.	Ridgefield Park, N. J.
Hodgskiss, William L.	Agriculture	Chouteau
Hollier, Georgia	History-Literature	Bozeman
Kenek, Maxwell W.	Electrical Engineering	Butte
Kruse, Jacob	History-Literature	Bozeman
Kiefer, James	Mathematics-Physics	Bozeman
Millegan, Homer D.	Agriculture	Millegan
Morgan, Nan J.	Biology	Bozeman
Olsen, Ella K.	Secretarial	Butte
Papke, William A.	Civil Engineering	Bozeman
Roecher, Raunie	Home Science	Bozeman
Schumacher, Frederic W.	Agriculture	Argenta
Spain, Roy	Agriculture	Bozeman
Solberg, Selmer H.	Electrical Engineering	Big Timber
Shiell, Helen	History-Literature	Buffalo

Stanton, Ruth .....	History-Literature .....	Helena
Switzer, Madge .....	Home Science .....	Bozeman
Truitt, Alonzo C. ....	Civil Engineering.....	Bozeman
Valleau, Vie H. ....	Art .....	Livingston
Vestal, William B. ....	Civil Engineering, Indianapolis, Ind	
Webster, Alden .....	Electrical Engineering.....	Bozeman
Whitworth, Wm. J. ....	Electrical Engineering.....	Deer Lodge
Winter, William .....	History-Literature .....	Bozeman

## FRESHMEN.

Abell, Tracy H. ....	Agriculture .....	Bozeman
Anderson, Albert .....	Secretarial .....	Bozeman
Batch, Otto C. ....	Agriculture .....	Helena
Border, Ernest J. ....	Agriculture .....	Bozeman
Burket, Alonzo D. ....	Chemistry .....	Bozeman
Breneman, Edith .....	Secretarial .....	Bozeman
Cheadle, Marie .....	Home Science.....	Lewistown
Coffee, Hazel .....	Home Science .....	Bozeman
Crittenden, Floyd .....	Secretarial .....	Bozeman
Cook, Donald H. ....	Electrical Eng. ....	White Sulphur Spgs.
Dahl, Hilmer L. ....	Mechanical Engineering.....	Belt
Davidson, Lyndall .....	Chemistry .....	Bozeman
Davis, Bryan .....	Mechanical Engineering.....	Neosho, Mo.
Eberle, Alfred E. ....	Agriculture .....	Butte
Eggen, Berger .....	Agriculture .....	Spokane, Wash.
Elliott, Archie .....	Agriculture .....	Great Falls
Fry, Matilda .....	Home Science .....	Elmo
Fitch, Meryl A. ....	History-Literature .....	Kalispell
Fiske, John M. ....	Electrical Engineering.....	Helena
Farrell, John B. ....	Civil Engineering .....	Joliet
Franzman, Bernice .....	History-Literature .....	Philipsburg
Goodson, Anna .....	Home Science .....	Livingston
Gray, Florence .....	Mathematics-Physics .....	Bozeman
Gray, Charles W. ....	Agriculture .....	Great Falls
Gray, Mary B. ....	History-Literature .....	Great Falls
Gray, Frank M. ....	Secretarial .....	Bozeman
Gummer, Harry A. ....	Agriculture .....	Frazee, Minn.
Hartman, Leah .....	Home Science .....	Bozeman
Harris, Richard .....	Agriculture.....	Park City
Haskins, Alanson .....	Chemistry .....	Bozeman
Haegele, Rowland .....	Agriculture .....	Helena
Hill, Hazel .....	Home Science .....	Missoula
Hillis, Thos. W. ....	Mechanical Engineering.....	Helena
Hopkins, Hazel .....	Secretarial .....	Anaconda
Hudson, Herbert C. ....	Civil Engineering .....	Sheridan
Ingersoll, Dixie .....	Home Science .....	Miles City
Johnson, Helen .....	Home Science .....	Kalispell
Jones, Jack .....	Agriculture .....	Frazee, Minn.
Kelly, Martin E. ....	Civil Engineering.....	Anaconda
Kelley, Robert T. ....	Civil Engineering.....	Anaconda
Kennard, Eveleen .....	Home Science .....	Kinsey
Kirby, Noah .....	Art .....	Gebo, Wyo.
*Lange, Charles E. ....	Electrical Engineering.....	Helena
Larson, Elmer N. ....	Civil Engineering .....	Livingston
Linfield, Alfred .....	History-Literature .....	Bozeman
Malsor, Roy E. ....	Civil Engineering .....	Anaconda
Martin, Flossie .....	Secretarial .....	Humansville, Mo.
McJilton, Mamie .....	History-Literature .....	Philipsburg
*Deceased.		



Mefford, Frederick .....	Mechanical Engineering.....	Rosebud
Miewald, Mabel .....	Home Science .....	Chinook
Moore, Inez .....	Secretarial .....	Bozeman
Morgan, Carl F.....	Civil Engineering .....	Joilet
Myers, Mae .....	Home Science.....	Billings
Noble, Edward G.....	Electrical Engineering.....	Whitehall
Piedalue, Aimee M.....	Secretarial .....	Bozeman
Pettigrew, Leslie.....	Electrical Engineering.....	Great Falls
Pickerel, Mark C.....	Electrical Engineering.....	Magnon, Ill.
Potter, John V.....	Electrical Eng.....	White Sulphur Spgs.
Powers, Walter J.....	Mechanical Engineering.....	Great Falls
Read, Martin G.....	Agriculture .....	Chouteau
Reynolds, George M.....	Secretarial .....	Big Timber
Roberts, Helen M.....	History-Literature .....	Havre
Roosevelt, George A.....	Agriculture .....	Ackley, Iowa
Sloan, Mary .....	Home Science .....	Bozeman
Steel, William H.....	Electrical Engineering.....	Great Falls
Sultzter, Willa .....	History-Literature .....	Butte
Sutherland, Edward L.....	Civil Eng.....	Central City, S. Dak.
Tait, John B.....	Agriculture .....	Anaconda
Talcott, Kenyon .....	Chemistry .....	Livingston
Taylor, Emma .....	Home Science .....	Bozeman
Tintinger, Lyle .....	Chemistry .....	Billings
Truchot, John .....	Agriculture .....	Chouteau
Valentine, Henry H.....	Mechanical Engineering.....	Helena
Walters, Harold J.....	Electrical Engineering.....	Chinook
Wells, Sarah .....	Home Science .....	Craig
Wilcomb, Maxwell J.....	Civil Engineering.....	Twin Bridges
Wilson, Kathleen .....	Home Science .....	Bozeman
Willson, Glenn I.....	Agriculture .....	Bozeman
Whipple, Charles A.....	Agriculture .....	Townsend
Wood, Christina .....	Home Science .....	Big Fork
Wood, Grant I.....	Agriculture .....	Big Fork

## IRREGULAR.

Anderson, Vera .....	Home Science .....	Bozeman
Bancroft, Alma Jane.....	History-Literature .....	Norris
Buell, Vera .....	Home Science .....	Bozeman
Cline, Eva .....	Art .....	Bozeman
Caldwell, Beulah .....	Home Science .....	Moore
Hamilton, Julia B.....	Home Science.....	Great Falls
Harmon, Florence .....	Home Science .....	Helena
MacDonald, Murdoch.....	Art .....	Norris
Morrison, Isabelle .....	Home Science.....	Whitehall
Wilson, Anna.....	Art .....	Bozeman
Wilson, Helen .....	History-Literature .....	Helena

## PREPARATORY SCHOOL.

## FOURTH YEAR.

Borthwick, Alberta .....	Home Science.....	Hamar, N. Dak.
Bidwell, Hugh .....	Mechanic Arts .....	Palmyra, Mo.
Bower, Edith .....	Home Science.....	Jeffers
Brook, Gladys .....	Home Science .....	Bozeman
Connor, Vivian .....	Scientific .....	Chouteau
Crouse, Lester .....	Mechanic Arts .....	Belgrade
Cheadle, Ned .....	Scientific .....	Lewistown
Dissley, William .....	Scientific .....	Sugar Creek, Ohio
Higgins, Patti .....	Home Science .....	Bozeman
Lorentz, Noyes .....	Mechanic Arts .....	Toston



Roberson, Elizabeth .....	Scientific .....	Sixteen
Sexton, Earl .....	Mechanic Arts .....	Belgrade
Smith, Vern .....	Mechanic Arts .....	Great Falls
Urbach, Albert .....	Mechanic Arts .....	Livingston

## THIRD YEAR.

Cook, Charles .....	Mechanic Arts .....	Roundup
Connor, Alden .....	Mechanic Arts .....	Chouteau
Carter, Howard .....	Mechanic Arts .....	Livingston
Elliott, Mae .....	Home Science .....	Clara
Flint, Nelson .....	Mechanic Arts .....	Bozeman
Hacker, Glenn .....	Scientific .....	Somers
Hacker, Ralph .....	Mechanic Arts .....	Somers
Jackson, Joel .....	Mechanic Arts .....	Harrison
Lindstrand, Florence .....	Home Science .....	Elso
McMillan, Anna .....	Home Science .....	Glengarry
Monson, William .....	Mechanic Arts .....	Ovando
Wellman, Bingham .....	Scientific .....	Augusta
White, Sylvanus .....	Mechanic Arts .....	Augusta

## SECOND YEAR.

Bacon, Arthur .....	Scientific .....	Butte
Cheadle, Constance .....	Home Science .....	Lewistown
Coombs, Vaughn .....	Mechanic Arts .....	Los Angeles, Cal.
Cowgill, Geyer .....	Mechanic Arts .....	Chouteau
Ellis, Mildred .....	Home Science .....	Bozeman
Ferris, Dorothy .....	Home Science .....	Bozeman
Finlay, William .....	Mechanics Arts .....	Bozeman
Ford, Albert .....	Mechanic Arts .....	Belgrade
Gerber, Elsie .....	Home Science .....	Sand Coulee
Graham, James .....	Scientific .....	Butte
Jacques, Henry .....	Mechanic Arts .....	Butte
Johnson, Ethel .....	Home Science .....	Dupuyer
McVay, Pauline .....	Home Science .....	Belgrade
Nelson, Albert .....	Mechanic Arts .....	Helmville
Pierce, Tom .....	Scientific .....	Bozeman
Pink, William .....	Mechanic Arts .....	Silver Star
Pope, Alger .....	Mechanic Arts .....	County Line, Ark
Riordan, Emmet .....	Scientific .....	Waterbury, Conn.
Roberts, Harvey .....	Mechanic Arts .....	Missoula
Sandberg, Harold .....	Mechanic Arts .....	Collins
Undem, Louis .....	Scientific .....	Chicago, Ill.
Young, Margaret .....	Scientific .....	Three Forks

## FIRST YEAR.

Beach, Ben .....	Mechanic Arts .....	Mitchell
Berg, Almon .....	Mechanic Arts .....	Lennep
Berg, Dagny .....	Home Science .....	Lennep
Berg, Helmar .....	Mechanic Arts .....	Lennep
Byersdorf, Otho .....	Mechanic Arts .....	Great Falls
Case, Fred .....	Mechanic Arts .....	Paradise
Cline, Marie .....	Home Science .....	Bozeman
Cook, Marcus .....	Mechanic Arts .....	Como
Corbly, Joseph .....	Mechanic Arts .....	West Virginia
Erwin, Kent .....	Mechanic Arts .....	Bozeman
Hamper, Edgar .....	Mechanic Arts .....	Radersburg
Harris, Earl .....	Mechanic Arts .....	East Helena
Jacobson, Peter .....	Mechanic Arts .....	Ovando
Johns, Opal .....	Home Science .....	Big Elk
Kipp, Harry .....	Mechanic Arts .....	Bozeman

McVay, Mitchell .....	Mechanic Arts .....	Belgrade
Porter, William .....	Mechanic Arts .....	Elso
Rorvik, Joseph .....	Mechanic Arts .....	Circle
Stone, Louise .....	Home Science .....	Belgrade
Stone, Frank .....	Mechanic Arts .....	Belgrade
Stone, Parker .....	Mechanic Arts .....	Belgrade
Sexton, Ray .....	Mechanic Arts .....	Belgrade
Thompson, Etta .....	Home Science .....	Sixteen
Vreeland, Frank .....	Mechanic Arts .....	Bozeman
Wallace, Richard .....	Mechanic Arts .....	Monarch

## IRREGULAR.

Barnard, Fred.....	Belgrade	Vicars, William.....	Livingston
Berg, Oswald .....	Lennepe	Wolfe, G. W.....	Moscow, Idaho
Lanz, Nathalie .....	Bozeman		

## ONE YEAR HOME SCIENCE.

Foley, Julie .....	Lewistown	Otten, Ella .....	Lewistown
Fletcher, Ruth.....	White Sulphur Spgs.	Phillips, Delia .....	Lewistown
Kemp, Bernice .....	Missoula	Seeley, Florence .....	Bozeman
Kickbush, Lily .....	Townsend	Wiegand, Elizabeth.....	Armington
Isaacs, Josie .....	Rancher		

## SCHOOL OF PHARMACY.

## THIRD YEAR.

Morris, Abbie F.....	Virginia City
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## SECOND YEAR.

Burfiend, Henry C.....	Dillon	Converse, Earl .....	Anaconda
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## FIRST YEAR.

Davis, Leon .....	Livingston	Lapeyre, Robert.....	Great Falls
Fischl, Louis .....	Helena	Miller, Horace .....	Butte
Gosman, George M.....	Dillon	Ross, William D.....	Dillon
Grant, Herbert P.....	Wilmot, Ohio	Solberg, Harold G.....	Big Timber
Gillis, Donald H.....	Butte	Stieb, Clyde.....	Hamilton
Herrin, Thos.....	Wolf Creek		

## SCHOOL OF AGRICULTURE.

## THIRD YEAR.

Bradshaw, J. Riley.....	Helena	Skeen, Orval.....	Judith Gap
Duffield, William A.....	Joliet	Schurch, Walter E.....	Deer Lodge
Kuecker Henry.....	Brownsville, Minn.	Seidensticker, John.....	Twin Bridges

## SECOND YEAR.

DeAtley, Gail.....	Clyde Park	Peterson, Frank T.....	Absarokee
Gray, Robert K.....	Bozeman	Summer, Fred .....	Clyde Park
Haight, Howard.....	Great Falls	Tietjen, Fred.....	Great Falls
Murray, William.....	Hamilton	Willis, Willard P.....	Plains
Northway, Glenn.....	Forsyth		

## FIRST YEAR.

Alphin, Fred .....	Wilsall	Clark, Walter .....	Joliet
Allard, Peter .....	Laurel	Cardwell, Emmett .....	Billings
Ashby, J. N.....	Bozeman	Cushing, Herbert C.....	Fairview
Berkey, Henry .....	Boyd	Davis, Clarence .....	Big Timber
Butler, Ivan .....	Helena	Durland, George .....	LaGrange, Ill.
Bryant, Louis .....	Columbus, Ohio	Dedrick, Henry.....	Billings
Ballard, Alfred .....	Townsend	Dawson, Fred .....	Stevensville
Ballard, Louis G.....	Townsend	Egeler, Fred .....	Clyde Park
Carpenter, Alvin.....	Clyde Park	Fry, Lewis .....	Elmo

Guy, Jack .....	Billings	Marvel, Ralph .....	Miles City
Gunn, Reuben V.....	Jacksonville, Ill.	Moore, Perry J.....	Twodot
Higgins, Ross .....	Dorsey	Nelson, Gene .....	Bozeman
Hamilton, Lawrence I.....	Ryegate	Newell, Raymond S.....	LaGrange, Ill.
Irwin, James .....	Billings	Nickelson, John .....	Livingston
Ireland, Henry B.....	Augusta	Smith, Allen H.....	Great Falls
Johnson, George .....	Billings	Schneider, Albert .....	Willard
Johnson, Melvin L.....	Dupuyer	Stacy, Edward W.....	Miles City
Johnson, Mandius C.....	Dupuyer	Skalitzky, Arthur .....	Bozeman
Karrow, Walter A.....	Milwaukee, Wis.	Stevens, Paul .....	Benchland
Kickbush, Carl .....	Townsend	Stevens, Harrell .....	Benchland
Lockwood, Theodore.....	Hamilton	Stanley, Marvin .....	Whitehall
Lindsay, William H.....	Butte	Timmons, John M.....	Havre
Morrison, Peter D.....	Whitehall	Van Camp, Arthur T.....	Twodot
McAdow, Louis H.....	Bozeman	Wilson, Carol W.....	Simmons ville, Vt.

### SCHOOL OF MUSIC.

Accola, Estella .....	Piano .....	Bozeman
Alderson, Myrtle .....	Piano .....	Marysville
Alexander, Maud .....	Piano, Harmony .....	Bozeman
Anderson, Ruth .....	Voice .....	Bozeman
Anderson, Vera .....	Voice .....	Bozeman
Baker, Florence .....	Piano .....	Bozeman
Bancroft, Alma .....	Piano, Harmony .....	Norris
Bartz, Mildred .....	Piano .....	Bozeman
Beck, Elsie .....	Piano .....	Bozeman
Bole, Margaret .....	Piano .....	Bozeman
Border, Lela .....	Piano .....	Bozeman
Borthwick, Alberta .....	Voice .....	Hamar, N. Dak.
Bull, Mildred .....	Piano .....	Bozeman
Busse, Carl C.....	Piano .....	Great Falls
Caldwell, Beulah .....	Piano, Harmony .....	Moore
Cooley, Esther .....	Piano .....	Bozeman
Cook, George .....	Voice .....	Como
Cunningham, Myrna .....	Piano .....	Bozeman
Duffield, William A.....	Voice .....	Joliet
Dusenbury, Inez .....	Voice .....	Bozeman
Elliott, May .....	Piano, Harmony .....	Lavina
Ennis, Kathrine .....	Piano .....	Bozeman
Ennis, Louise .....	Piano .....	Bozeman
Erwin, Mae .....	Piano .....	Bozeman
Fisher, Wallace .....	Voice .....	Bozeman
Fransham, Edna .....	Piano .....	Bozeman
Fransham, Eugene .....	Piano .....	Bozeman
Foley, Julie .....	Piano, Harmony .....	Lewistown
Gerber, Elsie .....	Piano .....	Sand Coulee
Glisson, Mrs. C. O.....	Piano, Harmony.....	Bozeman
Griffith, Gladys .....	History, Piano, Harmony.....	Bozeman
Hartman, Brooke .....	Piano .....	Bozeman
Hartman, Leah .....	Piano .....	Bozeman
Hartman, Ruth .....	Piano, Harmony .....	Bozeman
Hartman, Flora .....	Voice .....	Bozeman
Hinton, Hallie .....	Piano .....	Bozeman
Holbrook, Lorna .....	Piano .....	Livingston
Hollier, Georgia .....	Piano, Harmony .....	Bozeman
Hopkins, Hazel .....	Piano .....	Anaconda
Hutchinson, Hazel .....	Piano .....	Bozeman
Hutton, Dorothy .....	Piano .....	Jeffers
Johnson, Ethel .....	Piano .....	Dupuyer

Kammerer, Sophia .....	Piano .....	Bozeman
Kemp, Bernice .....	Piano .....	Missoula
Kennard, Eveleen .....	Piano .....	Miles City
Kenyon, Zona .....	Piano .....	Bozeman
Kirk, Christine .....	Piano .....	Bozeman
Kirschner, Hortense .....	Piano, Harmony .....	Bozeman
Kline, Marie .....	Piano .....	Bozeman
Kyle, Frances .....	Piano .....	Bozeman
Linfield, Leila .....	Piano .....	Bozeman
Linfield, Azalea .....	Piano .....	Bozeman
Martin, Atha .....	Piano .....	Bozeman
Martin, Flossie .....	Piano .....	Humansville, Mo.
Martin, Genevieve .....	Piano .....	Bozeman
McIntosh, Ethel .....	Piano .....	Bozeman
McVay, Mitchell .....	Piano .....	Belgrade
McVay, Pauline .....	Piano .....	Belgrade
Millegan, Guy .....	Piano .....	Millegan
Moore, Eleanor .....	Piano .....	Bozeman
Morrison, Isabelle .....	Piano .....	Whitehall
Morgan, George .....	Voice .....	Bozeman
Morgan, Joseph .....	Voice .....	Bozeman
Orvis, Worth .....	Piano .....	Salesville
Otten, Ella .....	Piano .....	Lewistown
Piedaloe, Laura .....	Piano .....	Bozeman
Phillips, Delia .....	Voice .....	Lewistown
Quinn, Bertha .....	Piano .....	Chestnut
Sales, Zada .....	Piano, Harmony, History .....	Bozeman
Schumacher, Hettie .....	Piano, Harmony .....	Bozeman
Settle, Ruby .....	Piano .....	Bozeman
Settle, Ruth .....	Piano .....	Bozeman
Shiell, Helen .....	Voice .....	Buffalo
Shovell, William L. ....	Voice .....	Hamilton
Smart, Lena .....	Piano .....	Bozeman
Smith, M. Alda .....	Piano .....	Dillon
Smith, Erma .....	Piano, Harmony .....	Bozeman
Spain, Helen .....	Piano .....	Bozeman
Stanton, Ruth .....	Piano .....	Helena
Stevens, Harrell .....	Piano .....	Benchland
Stout, Bertier .....	Piano .....	Bozeman
Tallman, Mildred .....	Piano .....	Bozeman
Taylor, Cybele .....	Piano .....	Bozeman
Truitt, Alonzo .....	Voice .....	Bozeman
Valleau, Vie H. ....	Piano, Harmony, Voice .....	Livingston
Van Camp, Mary .....	Piano .....	Bozeman
Wells, Sarah .....	Piano .....	Craig
Wiegand, Elizabeth .....	Piano .....	Arnington
Wilson, Helen .....	Piano, Voice .....	Helena
Wisseth, Willabelle .....	Piano .....	Odessa, Mo.
White, Helen .....	Piano .....	Bozeman
Widener, Carl .....	Voice .....	Bozeman
Young, Margaret .....	Piano .....	Three Forks

## HOUSEKEEPERS' SCHOOL.

Alderson, Mrs. Mary .....	Marysville	Cooley, Mrs. R. A. ....	Bozeman
Alphin, Mrs. Thomas .....	Wilsall	Cooley, Mrs. F. S. ....	Bozeman
Brewer, Mrs. W. F. ....	Bozeman	Cobleigh, Mrs. Wm. M. ....	Bozeman
Berg, Mrs. J. O. ....	Lennepe	Duncan, Mrs. Samuel .....	Belgrade
Barnes, Mrs. R. A. ....	Bozeman	Duncan, Mrs. B. S. ....	Bozeman
Carpenter, Mrs. L. M. ....	Clyde Park	Erwin, Mrs. W. S. ....	Bozeman



Eaton, Mrs. A. S.....	Rancher	McAdow, Mrs. N. B.....	Bozeman
Ferguson, Mrs. E. D.....	Bozeman	McAdow, Mrs. Lewis H.....	Bozeman
Ford, Mrs. George.....	Bozeman	Mainland, Grace .....	Great Falls
Ford, Bessie .....	Bozeman	Martin, Mrs. Don.....	Bozeman
Gray, Mrs. C. N.....	Great Falls	Morgan, Mrs. Lyman P.....	Bozeman
Green, Mrs. J. N.....	Belgrade	McDanral, Mrs. H. C.....	Logan
Griffin, Mrs. M. P.....	Bozeman	Pineckney, Mrs. R. M.....	Bozeman
Hayes, Mrs. M. E.....	Rockvale	Powers, Mrs. Ruth H.....	Bozeman
Hogan, Mrs. Ruby.....	Bozeman	Piedalue, Mrs. Joseph.....	Bozeman
Ham, Mrs. Frank W.....	Bozeman	Peterson, Mrs. C. H.....	Bozeman
Hollingsworth, Mrs. Wm.....	Bozeman	Robinson, Mrs. Wilbur.....	Manhattan
Hayes, Blanche .....	Bozeman	Robinson, Mrs. John M.....	Bozeman
Kirchaldie, Mrs. E. F.....	Great Falls	Seeley, Mrs. T. G.....	Bozeman
Kleven, Mrs. Lena.....	Bozeman	Thompson, Mrs. Homer C.....	Three Forks
Kiefer, Mrs. J. M.....	Bozeman	Turner, Mrs. Stella.....	Bozeman
Kelly, Mrs. A. N.....	Bozeman	Van Eman, Mrs. F. E.....	Augusta
Kirk, Mrs. Harris.....	Bozeman	Vicars, Mrs. T.....	Livingston
Jenisi, Louise .....	Lewistown	White, Mrs. Stephen.....	Bozeman
Lillard, Mrs. S. D.....	Rancher	Wath, Mrs. Donald.....	Lewistown
Linfield, Mrs. F. B.....	Bozeman		

#### FOUR WEEKS CREAMERY COURSE.

William Casthery.....	Butte	Gerara Makkee .....	Butte
A. A. Clute .....	Great Falls	James Norup .....	Butte

#### FARMERS' WINTER COURSE.

Allsop, Ezra .....	Bozeman	Fisher, T. J.....	Rancher, Wyo.
Allphin, Thomas .....	Wilsall	Gemmil, W. A.....	Evans
Bunnell, J. L.....	Helena	Gerhardt, G. H.....	Monarch
Brady, J. H.....	Cascade	Garnett, E. ....	Willowcreek
Belden, Harold .....	Utica	Gilchrist, Edgar.....	Belgrade
Ballantyne, J. T.....	Three Forks	Gunby, T. A.....	Maudlow
Ballantyne, John .....	Bozeman	Gideon, A. L.....	Clyde Park
Biering, John .....	Bozeman	Hammer, George .....	Bridger
Boddy, G. F.....	Bozeman	Hughes, R. H.....	Rockvale
Boddy, Ed. F.....	Bozeman	Haley, J. S.....	Bozeman
Bumgarner, C.....	Belgrade	Harding, Harry .....	Bozeman
Beall, F. E.....	Whitehall	Hoff, W. H.....	Bozeman
Beall, Edwin S.....	Whitehall	Hart, R. E. ....	Belgrade
Carpenter, L. M.....	Clyde Park	Hoffman, Morgan .....	Belgrade
Cushing, D. D.....	Fishtail	House, W. H.....	Bozeman
Christie, Geo. A.....	Bozeman	Hayden, J. F.....	Bozeman
Crittenden, W. J.....	Bozeman	Hogan, George R.....	Bozeman
Clark, F. F.....	Sedan	Huff, Joseph E.....	Bozeman
Cole, Simon .....	Manhattan	Howard, Weston .....	Augusta
Crum, J. C. ....	Bozeman	Hadsor, Robert C.....	Norris
Campbell, F. C.....	Flint	Hathorne, John H.....	Livingston
Carruthers, James L.....	Victor	Higgins, James M.....	Stevensville
Clark, John .....	Springdale	Howe, J. G.....	Stevensville
Dance, Roland B.....	Livingston	Holm, A. N.....	Butte
Davis, Wilbur .....	Bozeman	Hoyen, J. H.....	Melville
Dusenbury, V. F.....	Bozeman	Hodgskiss, Wm. ....	Chouteau
Devore, J. N.....	Bozeman	Johnson, T. H.....	Glendive
Degenhart, Lee C.....	Philipsburg	Jones, Robert .....	Wisdom
Eberhart, John .....	Bozeman	Jones, J. H.....	Cascade
Ector, A. S.....	Bozeman	Jones, Thomas T.....	Bozeman
Evans, P. E.....	Wilsall	Jones, Frank E.....	Helena
Fleeno, L. F.....	Benchland	Kellerher, J. C.....	Monarch
Fryberger, W. N.....	Lewistown	Keith, L. H.....	Hobson



Kannegaard, Clark G.....	Sedan	Rutledge, A. T.....	Belgrade
Kirk, J. S. ....	Bozeman	Robinson, Claude .....	Helena
Kirk, Harris .....	Salesville	Rundell, H. M. ....	Pony
Kountz, L. L. ....	Whitehall	Stevens, Sidney .....	Benchland
Lillard, S. D.....	Bozeman	Sanquist, Arthur L.....	Belgrade
Lovelace, L. T. ....	Bozeman	Schwartz, Ross L.....	Maudlow
Lyon, Geo. H.....	Bozeman	Sell, J. C. ....	Bozeman
Linguist, F. W.....	Helena	Sexton, F. L.....	Bozeman
Liquin, A. K.....	Wilsall	Sheet, T. L.....	Bozeman
Mainland, J. ....	Great Falls	Smart, J. M. ....	Bozeman
Morehead, J. H.....	Cascade	Smith, Ralph L.....	Bozeman
McAllister, Floyd .....	Bozeman	Smith, H. L.....	Bozeman
Miner, Wm. G.....	Logan	Sparr, Albert .....	Bozeman
Marston, Lea.....	Bozeman	Spring, George .....	Belgrade
McKee, O. S. ....	Bozeman	Swandal, Austin .....	Lennepe
Meserve, C. P.....	Bozeman	Steves, M. D. ....	Livingston
Meserve, Mrs. Irene .....	Bozeman	Smith, Kirk .....	Livingston
Moore, Sanford .....	Bozeman	Sowry, Arthur .....	Butte
Murray, Wm. J. ....	Bozeman	Thrasher, T. S. ....	Evans
Marston, Mrs. Lee.....	Bozeman	Tintinger, George .....	Cascade
Maynard, E. A.....	Jeffers	Te Selle, Henry .....	Manhattan
Martin, G. D.....	Big Elk	Taylor, Wm. E.....	Laurel
McNiven, John .....	Livingston	Uhl, John .....	Clyde Park
Mills, John L.....	Florence	Waite, D. S. ....	Lewistown
McHargue, O. F.....	Columbus	Wells, W. C.....	Kalispell
Oliver, C. L. ....	Joliet	Weber, Elmer G.....	Bozeman
Osborne, Arthur W.....	Bozeman	Webster, George H.....	Bozeman
Oldaker, J. A.....	Bozeman	Werner, B. ....	Bozeman
Peck, John .....	Garneill	White, M. L.....	Bozeman
Pasha, R. J.....	Bozeman	White, Matt W.....	Bozeman
Puncshank, J. W.....	Bozeman	Williams, Chester .....	Bozeman
Peterson, Carl G.....	Helena	Williams, Joseph B.....	Manhattan
Railey, Hampton P.....	Bozeman	Williams, J. C. ....	Bozeman

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# Twentieth Annual Catalogue

1912-1913

Montana  
State College of Agriculture  
and Mechanic Arts



Bozeman, Montana

*hvo*

# Calendar

1913.

Registration and Examination for Entrance and Conditions.....	Monday and Tuesday, September 8 and 9
Instruction Begins.....	8:00 A. M., Wednesday, September 10
Receptions by Christian Associations.....	Friday, September 12
Faculty Reception to New Students.....	Friday, September 19
Music Recital.....	Friday, September 26
School of Agriculture Begins.....	Tuesday, October 7
Columbus Day, a Holiday.....	Sunday, October 12
Standing of Students Reported.....	Friday, October 24
Thanksgiving Recess.....	Thursday, Friday and Saturday, November 27, 28, 29
Standing of Students Reported.....	Friday, December 12
Freshman-Sophomore Debate.....	Friday, December 12
School of Agriculture Examinations.....	Thursday and Friday, December 18 and 19
Christmas Vacation.....	Begins 12:00 M., Friday, December 19

1914.

Vacation Ends and Second Semester School of Agriculture Begins.....	8:00 A. M., Tuesday, January 6
Examinations Begin.....	9:00 A. M., Monday, January 26
Declamatory Contest.....	Thursday, January 29
First Semester Ends.....	Friday, January 30
Examinations for Conditions.....	Friday and Saturday, January 30 and 31
Registration for Second Semester.....	Tuesday, February 3
Lincoln's Birthday, a Holiday.....	Thursday, February 12
Washington's Birthday, a Holiday.....	Sunday, February 22
Extemporaneous Speaking Contest.....	Friday, February 27
Interscholastic Basket Ball Tournament.....	Thursday, Friday and Saturday, March 5, 6 and 7
Standing of Students Reported.....	Friday, March 13
School of Agriculture Ends.....	Friday, April 3
Oratorical Contest.....	Friday, April 17
Standing of Students Reported.....	Friday, April 24
Campus Day.....	Saturday, May 2
Arbor Day, a Holiday.....	Tuesday, May 12
Examinations Begin.....	9:00 A. M., Monday, May 25
Memorial Day, a Holiday.....	Saturday, May 30
Examinations for Conditions.....	Saturday, May 30
Baccalaureate Address.....	8:00 P. M., Sunday, May 31
Field Day.....	10:30 A. M. and 2:00 P. M., Monday, June 1
Music Recital.....	8:30 P. M., Monday, June 1



Class Day Exercises.....	Tuesday, June 2
President's Reception.....	9:00 P. M., Tuesday, June 2
Commencement.....	10:30 A. M., Wednesday, June 3
Alumni Meeting and Banquet.....	Wednesday Evening, June 3

## Montana State Board of Education

### Ex-Officio

GOVERNOR S. V. STEWART, Chairman.....	Helena
ATTY. GEN. D. M. KELLY.....	Helena
STATE SUPT. H. A. DAVEE, Secretary.....	Helena

### By Appointment

CHARLES H. HALL.....	Missoula
NATHAN R. LEONARD.....	Butte

(Term expires February, 1914.)

O. W. McCONNELL.....	Helena
WARD H. NYE.....	Billings

(Term expires February, 1915.)

WALTER S. HARTMAN.....	Bozeman
S. D. LARGENT.....	Great Falls

(Term expires February, 1916.)

G. T. PAUL.....	Dillon
H. G. PICKETT.....	Helena

(Term expires February, 1917.)

B. E. TOAN, Clerk of Board.....	Helena
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## Executive Board

PRESIDENT JAMES M. HAMILTON (ex-officio), Chairman....	Bozeman
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### By Appointment

J. F. BLAIR.....	Bozeman
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(Term expires April, 1913.)

J. H. BAKER.....	Bozeman
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(Term expires April, 1915.)

GEORGE COX, Treasurer.....	Bozeman
GEORGE R. CALLAWAY, Secretary.....	Bozeman

# Faculty

JAMES M. HAMILTON, M. S., (Union Christian College) President.  
Professor of Philosophy and Economics.

WILLIAM F. BREWER, A. M., (Harvard University)  
Professor of English.

MISS LILLA A. HARKINS, M. S., (South Dakota Agricultural College)  
Professor of Domestic Science.

ROBERT A. COOLEY, B. S., (Massachusetts Agricultural College)  
Professor of Zoology and Entomology.

WILLIAM D. TALLMAN, B. S., (University of Wisconsin)  
Professor of Mathematics.

WILLIAM M. COBLEIGH, A. M., (Columbia University)  
Professor of Chemistry.

JOSEPH A. THALER, E. E., (University of Minnesota)  
Professor of Electrical Engineering.

ALFRED ATKINSON, B. S. A., (Iowa State College)  
Professor of Agronomy.

ROBERT W. CLARK, B. S. A., (University of Minnesota)  
Professor of Animal Industry.

CHARLES S. DEARBORN, B. S., (Kansas State Agricultural College)  
Professor of Mechanical Engineering.

DEANE B. SWINGLE, M. S., (University of Wisconsin)  
Professor of Botany and Bacteriology.

ROBERT D. KNEALE, C. E., (Purdue University)  
Professor of Civil Engineering.

ORVILLE B. WHIPPLE, B. S., (Kansas State Agricultural College)  
Professor of Horticulture.

WALTER J. TAYLOR, D. V. M., (Cornell University)  
Professor of Veterinary Science.

FRANK W. HAM, M. S., (Montana State College)  
Professor of Physics.

CHARLES E. MOLLET, Ph. C., (University of Kansas)  
Professor of Pharmacy.

MRS. UNA B. HERRICK,

Dean of Women and Instructor in Physical Education for Women.

M. HERRICK SPAULDING, A. M. (Leland Stanford, Jr., University)  
Assistant Professor of Zoology.

MISS HELEN R. BREWER, A. B., (Grinnell College)  
Assistant Professor of History and Latin.

MISS MARY A. CANTWELL,  
Principal of the Preparatory School and Assistant Professor of English.

FRANK C. SNOW, C. E., (Ohio State University)  
Assistant Professor of Civil Engineering.

ROY C. JONES, B. S., (University of Vermont)  
Assistant Professor of Dairying.

FLORENCE BALLINGER,  
 Assistant Professor of Domestic Art.

MISS LANA A. BALDWIN, (Women's Art School, Cooper Union, N. Y.)  
 Assistant Professor of Art.

RUFUS A. BARNES, B. S., (University of Wisconsin)  
 Assistant Professor of Chemistry.

MISS CARRIE M. CEHRS, A. M., (University of Denver)  
 Assistant Professor of German.

MISS FRIEDA BULL, M. S., (Montana State College)  
 Instructor in Mathematics.

RALPH T. CHALLENGER, B. S., (Kansas State Agricultural College)  
 Instructor in Mechanical Engineering.

MISS ABIGAIL M. HESS, A. B., (University of Illinois)  
 Instructor in Home Science)

LYMAN G. SCHERMERHORN, B. S., (Massachusetts Agricultural  
 College)  
 Instructor in Horticulture.

HERBERT B. BONEBRIGHT, B. S. A., (Iowa State College)  
 Instructor in Agricultural Engineering.

MISS FLORENCE WALLIN, A. B., (University of Iowa)  
 Instructor in French and Spanish.

IRWIN T. GILRUTH, A. B., (Ohio Wesleyan University)  
 Instructor in English.

HARRY M. JENNISON, B. S., (Massachusetts Agricultural College)  
 Instructor in Botany and Bacteriology.

MISS GENEVIEVE LANE (Woman's Art School, Cooper Union, N. Y.)  
 Instructor in Art.

MISS THEDA M. JONES,  
 Instructor in Stenography and Typewriting.

F. CLIFFORD MILLER, B. S., (James Millikin University)  
 Instructor in Mechanical Engineering.

WILLIAM O. WHITCOMB, B. S., (North Dakota Agricultural College)  
 Instructor in Agronomy.

FRED KATELY,  
 Instructor in Mechanical Engineering.

WILL T. HAINES, B. S., (Montana State College)  
 Instructor in Electrical Engineering and Physics

ERNEST A. DOCKSTADER, A. B., (Colgate University)  
 Athletic Director.

ROY ORVIS WILSON, B. S., (South Dakota State College)  
 Registrar.

PAUL P. McNEELY, Mus. B., (Washburn College), A. B., Kansas  
 State University)  
 Director School of Music and Instructor in Piano.

U. HOLMES BISHOP (New England Conservatory)  
 Instructor in Vocal Music.

MISS BLANCHE McNEELY,  
Instructor in Piano.  
FRED O. JACKSON,  
Instructor in Violin and Orchestra.  
LOUIS L. HOWARD,  
Band Instructor.  
MRS. MARY K. WINTER,  
Librarian.  
GEORGE R. CALLAWAY,  
Secretary.

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#### STANDING COMMITTEES.

AGRICULTURE—Atkinson, Cooley, Clark, Whipple, Taylor.  
ASSEMBLY—Hamilton, Bishop, Gilruth.  
ATHLETICS—Swingle, Schermerhorn, Dockstader.  
BUILDINGS—Clark, Mollet, Thaler.  
COMMENCEMENT—Miss Cantwell, McNeely, Miss Baldwin.  
ENGINEERING—Thaler, Dearborn, Kneale, Snow.  
PUBLICATIONS—Brewer, Swingle, Kneale.  
REGISTRATION COMMITTEE—Ham, Wilson, Miss Brewer.  
SCHEDULE—Tallman, Ham, Atkinson.  
SCIENCE—Cobleigh, Tallman, Brewer, Cooley, Miss Harkins.  
STUDENT AFFAIRS—Miss Brewer, Spaulding, Mrs. Herrick, Jones,  
Miss Ballinger.  
STUDENT AID—Whipple, Miss Harkins, Mollet, Dearborn, Miss Cant-  
well.

## Experiment Station

#### STATION STAFF.

F. B. LINFIELD, B. S. A., Director.  
R. A. COOLEY, B. S., Entomologist.  
ALFRED ATKINSON, B. S. A., Agronomist.  
ROBERT W. CLARK, B. Agr., Animal Husbandman.  
EDMUND BURKE, B. S., Chemist.  
DEANE B. SWINGLE, M. S., Botanist and Bacteriologist.  
O. B. WHIPPLE, B. S., Horticulturist.  
W. J. TAYLOR, D. V. M., Veterinarian.  
J. B. NELSON, Superintendent Dry Farm Work.  
REUBEN M. PINCKNEY, B. S., A. M., Assistant Chemist.

L. F. GIESEKER, B. S., Assistant Agronomist.  
WM. F. SCHOPPE, B. S., Assistant Poultryman.  
H. E. MORRIS, B. S., Assistant Botanist and Bacteriologist.  
J. R. PARKER, B. A., Assistant Entomologist.  
LYMAN G. SCHERMERHORN, B. S., Assistant Horticulturist.  
R. F. MILLER, B. S. A., Assistant in Animal Industry.  
H. B. BONEBRIGHT, B. S. A., Agricultural Engineer.  
M. L. WILSON, B. S. A., Assistant in Dry Farm Work.

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In connection with the college, the Montana Agricultural Experiment Station is conducted. The object of this station is to further the interests of the agricultural industries of the State of Montana. This is done by conducting researches and experiments, which may include the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their various stages of growth; the various subjects connected with irrigation; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soil and water; the chemical composition of manures, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly upon the agricultural industry of Montana as may seem advisable.

The experiment station farm, consisting of 380 acres, adjoins the college grounds. It is provided with the necessary barns, granaries, tool houses, farm implements, live stock, gardens, greenhouses and orchards.

Sub-stations for experimental work in dry farming are maintained in various parts of the state and are conducted independently or in cooperation with the United States Department of Agriculture. A sub-station for experiments in horticulture has been established in the western part of the state.

The Montana Experiment Station is supported by the annual appropriations from the Federal government under the Hatch and Adams Acts, supplemented by growing appropriations from the state.

The station issues during the year a series of bulletins, which put in practical form the results of the experimental work. These are sent, upon request, to any citizen of Montana who will apply for them, and any such may have his name entered upon a mailing list and receive all bulletins as soon as issued.

Address, Director, Experiment Station, Bozeman, Montana.



# State College of Agriculture and Mechanic Arts

The purpose of the colleges of agriculture and mechanic arts is chiefly to provide industrial education in agriculture, engineering, household economy, and applied science, for the young men and women of the respective states in which they are located. The scope of the Montana State College is set forth in the two so-called Morrill Acts of Congress, which authorized this class of institutions and supplied in part endowment and funds for maintenance; and in an act of the Montana Legislature accepting the land and money grants from the national government.

The first Morrill Act of Congress of July 2, 1862, making a land grant for the partial endowment of the agricultural and mechanical colleges, states that the income from these lands shall be used to maintain colleges "where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The second Morrill Act of Congress, August 30, 1890, making an annual appropriation out of the treasury of the United States for the further support and endowment of these colleges, provides that this fund is "to be applied only to instruction in agriculture and mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic sciences, with special reference to their application to the industries of life; and to the facilities for such instruction."

The Act of the Montana Legislature, approved February 16, 1893, accepts these grants of lands and money and provides that the Montana State College shall have for its object "instruction and education in the English language, literature, and mathematics, civil and mechanical engineering, agricultural chemistry, animal and vegetable anatomy and physiology, the veterinary art, entomology, geology, and such other natural sciences as may be prescribed by the State Board of Education; political, rural and household economy, agriculture, horticulture, history, book-keeping, and especially the application of science and the mechanical arts to practical agriculture in the field, and irrigation and the use of water for agricultural purposes."

## ENDOWMENT.

The Enabling Act, providing for the admission of Montana into the Union, approved February 22, 1889, Sec. 16, grants 90,000 acres of land to Montana for the use and support of an agricultural college according

to the terms of the Act of Congress, July 2, 1862, and Sec. 17 grants an additional 50,000 for the same purposes, and subject to the same conditions and limitations as the other grant. The 140,000 acres of land cannot be sold for a price less than \$10.00 per acre, and the principal, together with all money received from the sale of timber, is to be invested as a permanent endowment. The unsold lands may be leased and the rentals, together with the interest on the permanent endowment, shall be used for the maintenance of the college.

The Act of Congress of August 30, 1890, appropriates \$25,000 annually out of the treasury of the United States. By the Nelson bill, passed March 3, 1907, this amount was increased annually by \$5,000 each year, beginning in 1907, until now the total annual appropriation has reached \$50,000, at which figure it is to remain.

### LOCATION.

Bozeman, the county seat of Gallatin county, is on the main line of the Northern Pacific railroad, and on a branch of the Chicago, Milwaukee and Puget Sound railroad. For convenience, healthfulness and beauty of surroundings, the location is unsurpassed. The college is situated on an elevation which commands a view of one of the most fertile valleys in the world, covered far and wide with grain fields, and hemmed in on all sides by lofty mountains.

Bozeman is a city of homes and churches, with a wholesome moral environment. It is a most desirable residence city for families who wish to educate their children. Expenses are moderate and there are all the conveniences of a modern city. The college is reached from the railroad stations and city by the electric car line.

### CAMPUS AND FARM

The grounds and farm contain three hundred and eighty acres. Forty acres in the immediate vicinity of the buildings constitute the campus and recreation grounds, which are in lawn, interspersed with flower beds, shrubbery, trees and driveways. The remainder is used for farming and experimental purposes.

### BUILDINGS

College Hall, situated in the center of the college campus, is a substantial structure of brick and stone, having a total length of one hundred and twenty-eight feet and a width of ninety feet. It is three stories high, and has a basement, which furnishes quarters for mechanical drawing and three class rooms. On the first floor are offices for the president and secretary, one room each for the Young Men's and the Young Women's Christian Associations, three large class rooms and the reading room and library. The north half of the second floor is devoted to the art department, the arrangement being such that three large rooms can be thrown together, by sliding doors. The south half of the second floor

is used by the department of civil engineering, and has one office, one seminar room, two recitation rooms and a drawing room. The third floor contains the large assembly hall and seven class and music rooms.

**Hamilton Hall.**—This is the new dormitory for women. It was named by the faculty for the late Mrs. James M. Hamilton. It is one hundred twenty by fifty-eight feet, three stories and basement. It is constructed of brick with hard wood floors and Oregon fir finish. It is equipped with steam heat, electric lights and baths. The rooms are single and in suites, and all rooms have both hot and cold water. In the basement are the store rooms, laundry, quarters for servants, kitchen and large dining room. The first floor contains the reception rooms, the Dean's suite, guest room and a number of rooms for students. The second and third floors are for students.

**Agricultural Hall** is a three-story building, one hundred and fifty feet by sixty-eight feet, pressed brick, tile roof, maple floors and modern equipment throughout. The north half of the first floor contains the quarters for dairying, consisting of storerooms, office, class room, butter and cheese rooms and laboratories. The south half of this floor is used for horticulture and has seed room, office, class room, work room, and laboratory. The north half of the second floor is occupied by the agronomy department, with office, class room, dry land office and soil and grain laboratories. In the south half are offices for the director of the experiment station, superintendent of farmers' institutes, class room, office and laboratory for the department of animal industry. The third floor is devoted to home economics, and contains two large kitchen laboratories, two dining rooms, two class rooms, three sewing rooms, offices and one room for training in nursing.

Adjoining the Agricultural Hall on the south is the new greenhouse with iron frame, cement floors and modern construction throughout. In the center of the front is a palm room 39 feet square and on both sides flower and vegetable rooms, 28 to 25 feet. Through the center is a plant breeding room, 98 by 20 feet, and on the west side a propagating room, 98 by 9 feet. The entire house is 98 feet by 68 feet, and joined to the agricultural building by a brick work room, 57 by 10 feet.

**The Chemistry and Physics Building** is located west of College Hall. It is 60' by 100 feet, of pressed brick, and is three stories high, including the basement. The basement is occupied by the physics lecture room, pharmacy lecture room and laboratory, the mineralogical and assay laboratory, and the museum of geology and mineralogy. The main floor is occupied by the office and department library, a lecture room, the food laboratory and the experiment station laboratory. The east half of the second story contains the laboratories for physics, and the west half the qualitative and the quantitative laboratories.

**The Biology Building**, consisting of three stories and basement, is brick veneered. On the top floor is a lecture room and a museum containing the zoological collections. On the floor below are three labora-

tories for bacteriology, botany and zoology, and an office and work room for the botanist. The west half of the first floor is a large laboratory for general biology, and the east half is occupied by the office, library and work room for the entomologist. The basement contains work rooms, class room, store rooms, herbarium room, and dark room. Attached to this building on the south is a greenhouse, 72 by 50 feet, for botanical purposes, and an insectary, 18 by 10 feet, for the study of living insects. The green house is divided into two rooms, one for experimental work and the other for laboratory use.

**The Engineering Laboratory** is a two-story stone building, 55 by 33 feet, with a frame annex 36 by 20 feet. The first floor contains the dynamos, motors, two steam engines, and strength of material testing machines. The second story is occupied by the storage battery, photometer and electric light rooms, class room, and the office of the professor of electrical engineering. The first floor of the annex contains the cement laboratories, and the second floor is used for electrical designing.

**The shops** are in a one-story frame building. The main part is 60 by 100 feet and contains a forge shop, 27 by 60 feet, a machine shop, 44 by 72, an office, a wash room, and a tool room. It has one wing 36 by 50 feet for woodwork, and another 36 by 48 feet for foundry.

**The Power House** is a brick building, 76 by 32 feet. It contains a 125 horsepower Stirling water-tube boiler, and 125 horsepower Root water-tube boiler. An 85 horsepower engine is directly connected with a 40 K.W. dynamo to furnish power for electric lights, the ventilating fans and the shops. There is also a 16 horsepower vertical type of engine and a 10 horsepower engine, which drives the fan for the power house stack.

**The Gymnasium** is a frame building. The main part is 100 by 60 feet, has hard wood floor, and on the ends and sides are permanent seats, amphitheater style. It furnishes a convenient place for gymnasium practice, basketball and other indoor athletics. An addition at the rear and sides, 90 by 14 feet, provides a director's office, two locker rooms, dressing room for women, shower and needle bath rooms, and a material room.

**The Cattle Barn** is a two-story frame building, 120 by 82 feet, and of fine architectural appearance. On the first floor is the dairy stable, quarters for young stock, a stock judging room, 40 by 40 feet, box stalls, feed bins and offices. The second story is used for storage of hay. All stables have cement floors and iron stalls.

**The Veterinary Building** is a two-story frame structure, 25 by 40 feet, with a one-story wing, 20 by 40 feet. On the first floor are the office of the veterinarian, two laboratories and an operating room. The second floor contains a laboratory and a class room.

**The Horse Barn** is a two-story frame building, 86 by 44 feet. It contains a living room, carriage room, feed bins, fourteen single stalls,

three double box stalls, and space for 100 tons of hay.

**The Beef Cattle Barn** is 50 feet square, with two wings each 24 by 28. It is equipped for feeding experiments and has feeding pens, space for hay, grain bins, and weighing room.

**The Sheep Barn** has a main part, 40 by 50 feet, and two wings, one 20 by 72 feet, the other 20 by 88 feet. In addition to the pens this building is provided with root cellar, wool and shearing rooms, hay loft, feed bins, and room for the attendant.

**The Seed Barn and Granary** is a two-story building and affords ample storage room for the field crops on the station farm.

**The Piggery** consists of a main building, 30 by 35 feet, with two wings, 16 by 50 feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each, for the hogs.

**The Poultry Plant** consists of two buildings. One is 122 by 15 feet, with a center extension 40 by 20 feet. The center contains the feed room, office, laboratory and living room. Underneath is the incubator cellar. One wing is a brooder house and the other has six pens with yards. The other house is 120 feet long and provides eight pens.

### HAMILTON HALL.

All women students whose homes are not in or near Bozeman are expected to live in Hamilton Hall. This building is completely furnished. All modern conveniences, such as hot and cold water in the rooms, baths, steam heat and electric lights, are furnished. The Hall is under the supervision of the dean of women and the residents have the care and training necessary for a family of students. The price of rooms (including board) varies according to location and size of room:

One in single room.....	\$24.00
Two in single room, each.....	22.50
One in double room .....	26.00
Two in double room, each.....	23.00
Two en suite, each.....	26.00
Three en suite, each.....	24.00

The above prices are for a calendar month. Of these amounts \$18.00 is for table board and the remainder for room rent. Application for rooms in the hall may be made at any time to the dean of women, or to the secretary of the college, and must always be accompanied by a deposit of \$5.00 to insure a reservation. This amount will apply toward payment of bills in the fall or will be returned if the secretary is notified before September 1st. Residents who leave the Hall before the close of the semester will be required to pay the room rent till the end of the semester. Payment for room and board must be made on the fifteenth of every month in advance, and after five days thereafter an extra charge of \$1.00 per week will be made as long as the bill remains unpaid, unless arrangements have been made to defer payment. Complete



arrangements are made for the reception of the residents the day before registration day, and no deduction will be made for late arrivals. The Hall will not be open for occupancy until the day before registration day. No deduction is made for absence at week ends or during vacations, except at the Christmas holidays, when room rent only will be paid. The residents may have guests at meals by making arrangements for same at the dean's office, the day before, and may also have the privilege of the laundry on Saturdays by paying a small fee. The residents are expected to furnish their own towel supply, dresser and table scarfs, and have same laundered; also a napkin ring and any room decorations they may fancy.

### ROOM AND BOARD FOR MEN.

There is no men's dormitory connected with the college, but about twenty young men can be accommodated at the club on the campus, where rooms and board may be had for \$20.00 per month. Students who do not live in Bozeman, or at the club, find room and board in private families convenient to the college, at from \$22.00 to \$25.00 per month. The total college expense for the year, including tuition, books, room, board and incidental expenses may be estimated from \$250.00 to \$350.00. A list of approved places with prices and accommodations is kept in the president's office. A committee of students meets all trains on registration days and at other times on request, and aids in finding satisfactory locations. Students arriving in Bozeman in the day time should take car from the depot to the college.

### FEES.\*

1—Annual matriculation fee for college, pharmacy, art, and school of home economics and mechanic arts courses.....	\$12.00
2—Annual matriculation fee for school of agriculture.....	6.00
3—Extra fee for late registration.....	\$2.00 or \$4.00
4—Special fee for removing condition caused by absence.....	2.00

### DEPOSITS.\*

Agriculture—Agronomy (2) per semester.....	\$ 2.00
Dairy (1), (2), (a) or (c) per semester.....	2.00
Horticulture (1) per semester.....	1.50
Horticulture (4) per semester.....	5.00
Horticulture (a) per semester.....	1.00
Art—Art (1), (4), (5), (6), (7), (8), (9), (a) or (b) per semester .....	1.00
Art (2) or (3) per semester.....	3.00
Art (10), (11), (12), (13) or (14) per semester.....	5.00

\*A fee is a fixed charge and no part is returned. The deposits cover the cost of materials and breakage in the laboratories and any unused balance is returned.

Biology—Biology (a) or (b) per semester.....	1.00
Biology (4), (5), (6), (c) per semester.....	1.50
Biology (10) or (12) per semester.....	6.00
Biology (1), (2), (3), (9), (11) or (13) per semester.....	3.00
Chemistry—Chem. (1) per year.....	8.00
Chem. (2), (3), (4), (5), (7), (8), (9), (15) per semester.....	8.00
Chem. (10), (11) or (12) per semester.....	6.00
Chem. (13) per semester.....	20.00
Engineering—C. E. (1), (2), (4), (11), (13), (15), (19), (20), (34) per semester.....	1.50
E. E. (4), (6), (10) or (12) per semester.....	3.50
Shop Work (a) per year.....	4.00
Shop Work (b) per year.....	6.00
Shop Work (d), (e), (f), (h), per semester.....	2.00
M. E. (2), (2a), (4), (4a), (9), (17), (21), (27), per semester..	2.00
M. E. (6) per semester.....	3.00
M. E. (14) or (15a) per semester.....	1.50
M. E. (20) or (28) per semester.....	5.00
Home Economics—H. E. (1).....	3.50
H. E. (5).....	2.00
H. E. (3), (4).....	5.00
H. E. (6).....	3.00
H. E. (8).....	1.00
H. E. (9).....	4.00
Sewing (12), (13), (14), (c), per semester.....	.50
Sewing (11) per semester.....	2.00
Sewing (16) per semester.....	.75
Sewing (a) per semester.....	1.00
Sewing (b), (c) per semester.....	1.50
Pharmacy—Phar. (1) or (10) per semester.....	4.00
Phar. (4) or (8) per semester.....	8.00
Phar. (5), (6) or (11) per semester.....	2.00
Physics—Physics (a) per year.....	1.00
Physics (1a) per year.....	2.00
Physics (2) per year.....	3.00
Physics (4) or (6) per semester.....	2.00
Physics (5) per semester.....	3.00
Typewriting—(3) or (4) for use of machine for one year.....	5.00
Veterinary Science (2) per semester.....	5.00
Veterinary Science (3) per semester.....	2.00

### ADMISSION.

Admission to the freshman class, in any of the college courses, is granted: (a) By a certificate of graduation from an accredited high school. (b) By examination in the subjects required by the college for entrance. (c) By faculty approval of grades from other than accredited

high schools. (d) By graduation from the school of home economics and mechanic arts.

Candidates for admission to the school of home economics and mechanic arts and the school of agriculture must have completed the eighth grade in the public schools or its equivalent. One year of high school work is required for admission to the school of pharmacy. There are no set requirements for music and the short agricultural courses, all being admitted who give evidence of being able to profit by the work. All candidates for admission to the institution in any department whatever are required to present the requisite diplomas or certificates for work previously done in other schools, and no registration is complete until such credentials are presented and passed upon.

### ENTRANCE REQUIREMENTS.

Fifteen units are required for admission to the freshman class in any college course.

Any one with not less than thirteen units may be admitted conditionally, but the units of preparatory work which have not been offered at entrance must be given preference over college subjects.

A unit for admission shall consist of work to the amount of five recitation periods per week of forty-five minutes each or four recitation periods per week of sixty minutes each, for a year of not less than thirty-six weeks.

Two periods of laboratory, shop work, or drawing shall count as one recitation.

In accordance with the present rules of the State Board of Education the following are required of all applicants for admission without condition to the freshman classes:

- 1—English composition and literature, 4 units.
- 2—Language other than English, 2 units.
- 3—Mathematics, 2 units.
- 4—Science, 1 unit.
- 5—History, 1 unit.

The remaining units will be selected from the following:

- 1—Language other than English, 4 units.
- 2—Mathematics, 2 units.
- 3—Science, 3 units.
- 4—History, including civics and economics, 3 units.
- 5—Drawing, 2 units.
- 6—Commercial subjects, 4 units.
- 7—Industrial subjects, including home economics, mechanic arts and agriculture, 6 units.

Admission without condition to the courses in engineering and mathematics-physics requires three years of mathematics and one year of physics.

### REGISTRATION.

**Matriculation.** Students entering the college for the first time must present their credentials or pass examination to determine their standing; and until such credentials are passed upon by the registrar or until examinations are passed in the subjects which may be required, the applicant for admission will ordinarily not be admitted to class work. This means that graduates of accredited high schools must bring to the college a recommendation certificate (forms will be furnished by the registrar), showing just what subjects credit is asked for, just how much time was given to such subjects and the grades attained. In addition to this, graduates from high schools not accredited may be required to pass examinations in the subjects offered. In the case of graduates from the eighth grade of the common schools, the certificate of examination must be brought to the college.

**Time for Registration**—The time set for registration of students is the first Monday and Tuesday of the first semester, and the first Tuesday of the second semester. The classroom work begins on the first Wednesday morning of each semester. No students will be registered on Wednesday, Thursday or Friday of the first week of each semester, except at the convenience of class officers between four and five in the afternoon. Those who fail to present themselves for registration before the first Wednesday in either semester, will be permitted to register later in the first week, only upon the payment of a special fee of \$2.00 in addition to regular fees. Those who apply for registration after the end of the first week of each semester will be registered only upon payment of a special fee of \$4.00 in addition to the regular fees. All special fees so collected shall go into the miscellaneous college fund. The faculty may at its discretion refund the special fee of any student, after the third month of the semester, upon definite proof that the tardy registration was necessary.

### HOW TO REGISTER.

I. All students who have registered here before—except graduates of the preparatory department registering as freshmen—will go directly to their class officers and obtain a class entrance card.

II. Those who have not registered here before and graduates of the preparatory department will:

(1) Fill out application blank.

(2) Secure the signature of the registrar.

(3) Take this signed application blank to the class officer in whose course registration is desired.

(4) From him secure a class entrance card.

III. After securing class entrance card, pay fees at secretary's office.

IV. Present class entrance card with secretary's stamp at the office of the registrar for approval.

Unless permission is granted by the faculty, class officers will register all students in accordance with the rules governing prerequisites, failures and number of credits. The registrar will examine all credentials for admission, and all grades earned in this and other institutions and report any irregularities in registration to the faculty. No registration shall be considered final until approved by the registration committee or the faculty.

**Amount and Regularity of Work.**—Students under twenty-one years of age will be admitted only to regular courses or to work as nearly regular as their preparation allows, unless on special action of the faculty. Students over twenty-one will be admitted to such work, not less than twelve credits (allowance being made for music), as the schedule permits and their class officers approve, and the twelve credits shall include at least six credits of lecture or recitation work.

**Change of Registration.**—A student desiring to change his studies will present his request to his class officer, who, after consulting all teachers interested, will take such action as he may deem best. Change in registration will be made after four weeks for extraordinary reasons only. Requests for change in registration will not be considered during the last eight weeks of a semester. A change in course of study is allowed by a vote of the faculty only.

**Credits Necessary for Registration.**—It is the sense of the faculty that any student not passing in ten credits is wasting his time, and ordinarily he will not be re-registered when he has failed to pass in ten credits the preceding semester.

**Registration by Mail.**—Most of the details of registration can be arranged in advance by mail, and students are requested to arrange their work so far as possible in this way. Those who enter the institution for the first time should write several days in advance of the college opening, inclosing their credentials, as specified in the paragraph on matriculation above, to the registrar of the college, and should state the work which they wish to take. These documents will be examined and the student's classification ordinarily be determined before his arrival, so that much time in registration may be saved. Those who have been already enrolled in the institution should send a letter to their class officers several days in advance of the registration days, telling clearly the work which they plan to take and, in the case of elective subjects, stating briefly the reasons for their choice.

If these steps are taken by students, registration should be completed with a minimum expenditure of time; but no student's registration will be complete until he applies at the college in person.

Students who plan to arrange their registration by mail, as specified above, should study carefully the entrance requirements for the courses in which they are interested, and the prerequisites to the various subjects which they wish to take up.



### ABSENCES.

Students absent from required exercises are reported at the close of each day to the president's office. Excuses for absence are not required, but students are subject to discipline by the class officers' committee at any time for absences from required exercises. Whenever the number of absences in any class during a semester exceeds twice the number of credits in the course the student does not receive a passing grade in that subject until the work has been taken up. Work shall be made up by a special examination or in such other manner as the instructor may prescribe, and a fee of \$2.00 must be paid to the secretary of the college before a student can make up work on account of absence, but the class officers' committee may remit the fee on recommendation of the instructor. The instructors deal with tardiness in such manner as they deem best.

**Leave of Absence.**—When it is necessary for a student to be absent from the city, application must be made to the president for leave of absence. A leave of absence is a justification for absence from class, but does not give relief from the work omitted.

### GRADES.

**Passing Grades.**—Passing grades are marked A, B, C or D. An average standing from 90 to 100 is A, from 80 to 90 is B, from 70 to 80 is C, and from 60 to 70 is D.

**Conditions and Failures.**—Work not of a passing grade shall be marked E, if in the judgment of the instructor it can be made up or completed without repeating the course in class. Work not of a passing grade shall be marked F, if in the judgment of the instructor it cannot be made up or completed without repeating the course in class. A mark of E is a condition and may be removed by an examination or in such other manner as the instructor may prescribe. Examinations for removing conditions shall be held on the days designated in the college calendar. A mark of F is a failure and must be made up by repeating the subject in class. When a condition is not removed by the time the subject is offered the following year it lapses into a failure. The above marks apply to laboratory, shop work, drawing and other exercises, as well as to lecture and recitation courses.

Students whose work is unsatisfactory will be reported to the class officer and the president, and information will be sent to the parents or guardians.

**Credits.**—For convenience in estimating the requirements for a degree, the following rules are laid down: One hour a week, for a semester, of recitation or lecture work, or two and one-half hours a week for a semester of laboratory, shop, library work, or drawing, shall count as one credit.

If for any reason the full time is not occupied in the shop, labora-

tory, drawing room or library, the remainder shall be used under the supervision of the instructor for outside work.

No regular student may take in any one semester work amounting to less than twelve credits, nor more than nineteen, unless a greater number are prescribed in the course.

Grades brought by a student from another institution will be accredited in this college only after personal conference with and approval by the head of the department in which credit is desired.

### GRADUATION AND DEGREES.

**Bachelor's Degree.**—Candidates for the bachelor's degree must complete satisfactorily one of the college courses as outlined and not less than 130 credits; including also a thesis the value of which in credits shall be determined by the instructor concerned. Students who are relieved for any reason of the requirements in military drill or gymnasium shall present four additional credits in some other subjects.

The degree of Bachelor of Science is conferred upon students completing the work prescribed in any one of the college courses and the name of the course taken is placed on the diploma.

In order to complete a course satisfactorily and receive a degree a student must earn as many points as there are credits in the course. In calculating points, A grades count three times as many points as credits, B grades two times, C grades the same number, and D grades zero.

All students whose points are two and one-fourth times the number of credits at the time of graduation will receive the degree "With Honors."

**Master's Degree.**—The candidate must hold a bachelor's degree from this college or another of at least equal rank, and in the line of work for which he applies for the master's degree, he shall have sufficient preparation in his major subject to enable him to carry on research work. He shall complete the full year of resident study of not less than thirty-two credits.

There shall be one major subject and one or two minors, the major being equal to ten credits per semester. The plan of the work must be approved by the committee on graduate work by October 1. The candidate shall also present a thesis embodying the results of original research which may be part of the credits required for the major subject.

**Engineering Degrees.**—Resident graduates in engineering may earn the degree of Civil Engineer, of Electrical Engineer, or of Mechanical Engineer, on the same basis as candidates earn the degree of Master of Science. Non-resident graduates in engineering must have at least three years of successful professional experience, must present an acceptable thesis, and must pass an examination before the special committee on degrees.

### MISCELLANEOUS.

**Government.**—Students are expected to conduct themselves as ladies and gentlemen; those who fail to comply with this demand will be requested to leave the institution.

**Work for Exhibition.**—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for the period of one year.

**Student Organizations.**—All public performances, given by students or student organizations, using the name of the college, will be under the supervision of the committee on student affairs.

So far as possible all college gatherings will be held on Friday and Saturday evenings. This includes class and student organizations. Students will not be out evenings from Monday to Friday except to attend something of unusual interest and value.

**Military Drill.**—All male students, except aliens, those physically disqualified, members of the junior and senior classes, and student assistants, are required to take military drill, satisfactory work being requisite for graduation.

Military drill is in charge of a United States Army officer and a minimum of two years' drill is required. Each student in military drill must provide himself with a uniform, which is purchased through the secretary of the college, and costs about fifteen dollars.

**Music as an Elective.**—Music to a total of not more than four credits may be counted toward a degree in those courses which allow free electives. To those regular students who elect music the college will furnish free one thirty-minute lesson a week during the junior and senior years, or either semester of either year; and the work may be elected in either vocal or instrumental music.

**Assembly.**—Students are required to attend the assemblies held on the second and fourth Fridays of each month and all special assemblies. The programs at these assemblies consist of addresses, music recitals, illustrated lectures, etc. Meetings of student organizations are held on the first and third Fridays of each month.

**Honorable Dismissal.**—Students intending to sever their connection with the institution, either indefinitely or permanently, should report as soon as possible to the president, either in person or in writing, giving proper explanation, and should apply for an honorable dismissal. Students leaving the institution without such honorable dismissal (except at the end of the college year), will not be readmitted to the college at any later time, nor will any reports or grades in credit for work done here be sent out until satisfactory explanation is made.

### COLLEGE ORGANIZATIONS.

**Young Men's Christian Association.**—The association is undenominational and is well fitted to promote the moral and religious life of students. It conducts mission and Bible study courses, and prayer meet-

ings and secures addresses by religious workers. The association promotes good fellowship by giving social entertainments, assists new members to get started in college life and aids in securing employment for those who wish to work their way through college.

**Young Women's Christian Association.**—The object of this association is the symmetrical development of Christian womanhood. It co-operates with the Y. M. C. A. in its social and religious work among the students. It conducts devotional meetings and carries on systematic Bible study. Several delegates are sent to the Northwest Conference each year and an active interest is maintained in the state association.

**Debating Council.**—The management of the work in inter-class and intercollegiate debating, in extemporaneous speaking, and in oratory, is now vested in a debating council, which works in co-operation with the department of English. Annual debates are now held with the Agricultural College of Utah, and the State University of Montana, and with the Montana Wesleyan University. There is an established debate each year between the freshman and sophomore classes. There is a state contest in oratory and extemporaneous address in which five institutions of the state participate.

**The Exponent.**—The students of the college maintain an excellent weekly paper, The Exponent, which has also a monthly literary supplement. The paper is well supported by the students and outside advertisers and has become one of the most important and successful of student enterprises. It compares favorably with the best college publications in the United States and affords the members of the staff very valuable literary training.

**The Jack o'Lantern Club.**—The purpose of this club of students is the studying and presenting of the modern drama. The work is done under the direction of the English department.

**Athletic Association.**—This association has general control of all athletic interests of the college, subject to the approval of the faculty. Football, baseball, basketball, track and tennis are maintained. A part of the annual matriculation fee is appropriated to athletics and all students thus become members of this association without additional cost.

**Pharmaceutical Society.**—The society was organized for the purpose of arousing a greater interest in scientific matters of practical importance to the pharmacist. Monthly meetings are held and current events in pharmacy are discussed and scientific papers and talks are presented by the instructor, students, practical pharmacists, and others.

**Branch of the American Institute of Electrical Engineers.**—A branch of this society has been organized at the college. Regular monthly meetings are held at which original papers are read or those of the Institute discussed. Students and teachers are kept in touch with practical engineers and their problems. Only regular members or student members of the American Institute are eligible to membership in this branch.



There is, however, an Electrical Club which includes all the members of the Institute and all other students in the electrical engineering course.

**The Civil Engineering Society.**—The students of the department of civil engineering organized the society for the purpose of promoting their interests in matters of practical importance to engineering students and alumni. Prominent engineers who have succeeded in special fields frequently meet with the members of the society to discuss the problems of their field. Meetings are held bi-monthly.

**College Band.**—The college band of forty-five members, under the instruction of Mr. Louis Howard, is one of the best amateur musical organizations in the state. The college provides instruments, music and instruction. The band is divided into two sections, beginners and experienced players. This gives a splendid opportunity for those who have never played and those who have some skill in the use of instruments.

**Engineering Society.**—The object is to aid its members financially by purchasing at wholesale rates, books, materials and instruments.

**Agricultural Society.**—All agricultural students are eligible to membership in this society. Regular meetings are held for the discussion of topics of interest in scientific agriculture with special reference to the possibilities of farm life. A bookstore for the members has been conducted for several years.

**Male Glee Club.**—Men students who have the necessary range and quality of voice are admitted. Music and instruction is free. Rehearsals are held twice a week under the direction of the instructor of vocal music. College and home songs as well as the works of the foremost American composers are studied.

**Ladies' Glee Club.**—This club consists of sixteen voices, otherwise it corresponds with the Male Glee Club. The same type of music is studied, and the rehearsals are held twice a week. Twice a year the clubs appear in joint concerts, performing the works studied, and forming also a mixed chorus. Separate public appearances are frequent.

**Orchestra.**—The M. S. C. orchestra is an organization composed of students of the college. Last year its membership numbered twenty, but it is the aim of the director to have at least forty members for the year 1913-14, in order that they may work on some light symphony music.

**Home Economics Club.**—This club is composed of women students who are working for a degree in home economics. Meetings are held twice a month for the discussion of topics of interest to students in home economics and also to keep in touch with the work of the alumni of this department.

**The Chemical Society.**—The students taking the Chemistry Course join this society for the purpose of developing an interest in the professional side of the subject and also for studying topics that do not come up in regular class work. Regular meetings are held and abstracts of recent journal articles are presented.



**College Union.**—To provide recreation facilities, especially during the winter months, when outside games are not possible, the College Union has been formed. This organization includes all men students and faculty members in the institution, and has its headquarters in the College Union rooms on the fourth floor of Agricultural Hall. These rooms, which were fitted up during the summer of 1912, include two large game and recreation rooms and one reading room. In the game rooms, pool and billiard tables and the parlor games, such as chess and checkers, are provided. In the larger of these rooms, there is also a piano and good facilities for recreation and social intercourse on the part of the men students. In the reading room is placed an assortment of the popular magazines, as well as desks and all the necessary writing facilities. These rooms have been in use for the first time, during the present year, but the very general use by the student body shows that they have met a very apparent want in the institution.

**Social Clubs.**—Greek letter fraternities are not permitted. Clubs which have for their object the improvement of the social life of their members are authorized. Two clubs of this kind are the Triangle X and the Kayenne. The former maintains a house in which its members live. These clubs, like other student organizations, are under the supervision of the faculty.

### CONTESTS.

**Prize in Oratory.**—An annual prize of twenty dollars is given to the winner of the annual local oratorical contest. This is open to all students. The winner represents the college in the state oratorical contest.

**Armstrong Prize in Declamation.**—Hon. F. K. Armstrong, of Bozeman, gives a prize of ten dollars to the winner of the annual declamatory contest of the preparatory school. There is also a second prize of five dollars. Only regular students are eligible.

**Extemporaneous Speaking.**—Hon Nelson Story, Jr., gives an annual prize of twenty-five dollars toward an Extemporaneous Speaking Contest. Fifteen dollars is given as first prize, and ten dollars as second prize. This contest is open to students of the Preparatory School.

### SCHOLARSHIPS.

The State Board of Education has established a four-year scholarship in each of the accredited high schools for the student who receives the highest average grade in his class. These scholarships are awarded each year by the high school principals for their respective schools. This scholarship excuses the holder from paying any tuition or deposits. Any one winning a scholarship may choose any of the state institutions.

**Federation Scholarship.**—The State Board gave to the Montana Federation of Women's Clubs a scholarship in each of the four state colleges at the June meeting in 1912. In September, 1912, the executive board of the Federation elected Miss Mollie Allen of Butte and chose for her the

home economics course in the Montana State College. The Federation pays all of Miss Allen's college expenses, including board, room rent, books, athletic ticket and gymnasium suit.

### ACCREDITED HIGH SCHOOLS.

Following is a list of the accredited high schools of the state:

(1) **City High Schools.**—Anaconda, Belt, Billings, Butte, Chinook, Columbus, Forsyth, Fort Benton, Glasgow, Great Falls, Hamilton, Havre, Helena, Laurel, Plains, Pony, Stevensville, Victor, Virginia City.

(2) **County High Schools.**—Beaverhead, Dillon; Broadwater, Townsend; Carbon, Red Lodge; Custer, Miles City; Dawson, Glendive; Fergus, Lewistown; Flathead, Kalispell; Gallatin, Bozeman; Granite, Philipsburg; Jefferson, Boulder; Missoula, Missoula; Park, Livingston; Powell, Deer Lodge; Sweet Grass, Big Timber; Teton, Choteau.

(3) **Parochial High School,** Butte; Sacred Heart Academy, Missoula.

### EMPLOYMENT FOR STUDENTS.

A number of students earn a part of their expenses while in college. Students expecting to work their way should come with sufficient money to pay their expenses for one semester unless they have engaged work in advance. The college cannot guarantee employment, but those who are willing to give efficient, faithful service have usually found work.

A few students are employed as janitors and as assistants in the shops, laboratories and barns. Others care for furnaces, horses and cows in the city, work in stores and at various kinds of house work. Calls for young lady students to work for their board are numerous.

Students readily find employment at profitable wages during the summer vacation. A large number annually get work with the transportation companies in the Yellowstone National Park as drivers, camp-attendants and domestics. Engineering students are placed with the reclamation service, the railroads, and the electric power plants.

A faculty committee aids students to find employment. Those desiring work should write, stating experience and kind of work desired.

### LIBRARY AND READING ROOM.

**Public Depository.**—By Act of Congress the library is now a depository and receives all public documents and other printed matter issued by the United States government.

**Main Library.**—The main library is in two large, well lighted rooms on the first floor of College Hall. The library contains 11,300 volumes, not counting public documents, and about 6,000 pamphlets. It is well supplied with standard works in technology, history, science and literature, as well as with dictionaries, cyclopedias and other reference works. About \$1,500 is spent annually for books and periodicals.

**Department Libraries.**—The agricultural library occupies two rooms, on the second floor of the Agricultural Hall. It contains almost complete bound sets for all state experiment station bulletins and United

States Department of Agricultural publications, besides a large number of agricultural papers and standard works. One large room on the first floor of the biology building is used for the library and periodicals of the biological department. The library of the chemistry department is located in the office of the chemist in the chemistry building.

### ATHLETICS AND PHYSICAL TRAINING FOR MEN.

The gymnasium is described on page 11 of this catalogue. This furnishes some room for basketball practice and games, for baseball and football practice in bad weather and for gymnasium practice of various kinds during the winter months. A small amount of apparatus is available. The college furnishes the necessary equipment and materials for basketball, football, baseball and track athletics.

The work of this department includes three main lines—the coaching of athletic teams to represent the college in outside contests; the training of such men as present themselves during the winter for work in wrestling, boxing and indoor work; and the general supervision of the physical welfare of all the students through a system of physical examination and prescribed exercises.

The college has been represented in inter-collegiate athletics during the past year by teams in basketball, track athletics, and football. Eligibility in these teams is determined under the rules of the Montana Inter-Collegiate Athletic Association.

At the middle of each college year all the students of the college are requested to present themselves for a thorough physical examination; and on the showing thus made the instructor prescribes certain forms of exercise for each student, and makes certain recommendations regarding diet and hygiene. At each recurring annual examination the improvements are noted and further suggestion made.

**Athletic Field.**—The new athletic field located south of the main building has been completed during the year. It consists of a quarter mile 20 foot cinder running track with a 130 yard straight-away. The inside field is graded for use as a football gridiron and baseball diamond. A neatly constructed grandstand with a seating capacity of 500 has been provided. There are two good cement tennis courts.

### PHYSICAL EDUCATION FOR WOMEN.

The aim of the physical education department for women is to develop each girl to her highest economic value, as a unit of society, to the end that when she finishes her college course she may carry forth into life a sane, well balanced, logical mind, high moral character and a strong symmetrical properly functioning body, capable of assuming and performing cheerfully and well the duties of cultured womanhood.

**First Year.**—Physical examination on entering. The chief aim throughout the year is to establish good posture and carriage and strengthen vital functions. The work will consist of Swedish body build-

ing work, some floor tactics, German rhythmic dancing and games.

Class exercises twice a week required.

**Second Year.**—The work for second year students will be built on first year's work. Light apparatus, folk dancing, gymnasium games.

Class exercises twice a week required.

All through the two years the course includes lectures on personal hygiene; general deportment for girls; dress from the standpoint of health and appearance; the physiology of bodily exercise. The regulation gymnasium suit and shoes, which may be obtained from a local dealer will be required.

### **BASKET BALL TOURNAMENT AND SPEAKING CONTEST.**

The annual high school basket ball tournament and speaking contest is held on Thursday, Friday and Saturday nearest the tenth of March. The railroad fares and the room and board for three days in Bozeman are paid for six basketball players and one speaker from each high school. All accredited high schools are eligible to participate. Rules of eligibility are determined and protests decided by the Montana High School Athletic Association. A cup is awarded the champion team. In connection with the tournament an extemporaneous speaking contest is held.

### **ORGANIZATION OF INSTRUCTION**

A. The following four-year college courses, each leading to the degree of Bachelor of Science, are offered:

1—Division of Agriculture.

1, Agronomy; 2, Animal Industry and Dairying; 3, Horticulture.

2—Division of Engineering.

1, Civil Engineering; 2, Electrical Engineering; 3, Mechanical Engineering.

3—Division of Industrial Arts and Sciences.

1, Biology; 2, Chemistry; 3, Home Economics; 4, Mathematics-Physics, 5; Vocational English.

B. The following courses, not leading to a bachelor's degree are offered:

1—School of Home Economics and Mechanic Arts.

2—School of Agriculture.

3—School of Pharmacy with the degree of Ph. C.

4—Art School.

5—Music School.

### **NOTATION.**

In the following tables and descriptions of courses the signs used are as follows: All numbers given in the parentheses are the numbers of the courses and the description of the work may be found by these numbers. So the notation (Math. 3) means that the course referred to

is the course in mathematics numbered 3 which is analytical geometry and calculus. The letters of the alphabet without numbers are used in parentheses in the same way to indicate courses of sub-freshman rank. The arabic numbers used without parentheses in the tables and in the description of the courses indicate the number of credits toward graduation allowed for the subject. In the description of the courses the Roman numerals, I and II are used to designate the first and second semesters. M., T., W., Th., F., and S., are used to indicate the working days of the week, and the numerals "10 to 11" or "3 to 4" to indicate the morning or afternoon hours. In the case of elective subjects, no hours are given. The time of the recitations for elective subjects will be announced as the work is called for.



## Division of Agriculture

Four-year courses are maintained in (1) Agronomy, (2) Animal Industry and Dairying, (3) Horticulture. The aim is to give a scientific and practical training for the agriculturist, the stockman, the dairyman and the horticulturist. The work is the same for the first two years. At the beginning of the junior year the student chooses the group in which he desires to specialize. The completion of the new agricultural building, the purchase of additional lands, and the erection of farm buildings and barns, afford ample accommodation for the agricultural work. The equipment and other facilities are described in connection with the courses of study.

**AGRICULTURE.**

**FRESHMAN YEAR.**

First Semester.		Second Semester.	
English Composition (Eng. 1).....	2	English Composition, (Eng. 1).....	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
General Chemistry (Chem. 1).....	4	General Chemistry (Chem. 1.).....	4
General Botany (Biol. 9).....	5	Plant Physiology and Histology	
Trig. and Log. (Math. 2a).....	3	(Biol. 10).....	4
Farm Dairying (An. Ind. 8).....	3	Prin. Plant Culture (Hort. 1).....	3
Drill .....	1	Animal Types (An. Ind. 1).....	3
	—	Drill .....	1
	19		18

**SOPHOMORE YEAR.**

Expository Composition, (Eng. 2) 2	Expository Composition (Eng. 2) 2
Qualitative Analysis (Chem. 2).. 4	Organic Chemistry (Chem. 5)..... 5
Gen. Des. Phys. (Phys. 1a)..... 3	Gen. Des. Phys. (Phys. 1a)..... 3
Invertebrate Zoology (Biol. 1).... 4	Animal Phys. and Anat. (Biol. 3) 5
Field Crops (Agron. 1)..... 5	Geology (Geol. 1)..... 3
Drill .....	1
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	19

## Course in Agronomy

Agronomy is the science of the field and its crops. It treats of the production and improvement of field crops, the cultivation of soils and the maintenance of their fertility, and general farm management, which is the application of economic business methods to farm practices.

Because of the peculiar agricultural conditions existing in western states, a new agriculture is being developed. The handling of dry farming lands is necessary only in the West. The problems which have to do with irrigation water, and the cultivation of the soil and management of the crops under irrigation must be solved by the western investigators and agriculturists. It is to fit men to deal with these and other questions of production of the farm that this course is offered.

The first two years of the agronomy course are devoted to the study of the natural sciences, languages and some general agricultural work. This places the student in a position to appreciate and intelligently discuss the methods of practice taken up later in the course.

The last two years of the course are designed to give the student clear insight into methods for the cultivation and maintenance of the fertility of the soil; the peculiarities of the growth and handling of different crops; the arrangement, the laying out of the farm, and the principles which govern successful farm management.

With a constantly growing appreciation of the value of the agricultural lands of the West, comes an active demand for young men trained along the lines of practical and scientific agronomy, men who combine college training with practical experience and native ability. Such training is offered to young men in this course. The demand for such students is unlimited, at a compensation not exceeded in any other calling. A few of the many lines open to graduates of this department are: college and experiment station work, agricultural journalism, management of large irrigated and dry farms, management and salesmanship for seed firms, and superintendencies for companies with large land holdings.

AGRONOMY

JUNIOR YEAR.

First Semester.

Economics (Econ. 3).....	2
Soil Physics (Agron. 2).....	5
Agricultural Chemistry (Chem. 7).....	4
Bacteriology (Biol. 12).....	5
Elective.....	2 or 3

Second Semester.

Economics (Econ. 3).....	2
Soil Fertility (Agron. 3).....	3
Farm Mechanics (Agron. 4).....	3
Plant Pathology (Biol. 11).....	4
Care and Management of Live Stock (An. Ind. 6).....	3
Organic Evolution (Biol. 14).....	2
Elective .....	2

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18 or 19

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19

SENIOR YEAR.

Farm Management (Agron. 6)....	4
General Entomology (Biol. 4).....	4
Plane Surveying (C. E. 1).....	5
Elective .....	6

Principles of Breeding (Agron. 7) ..	4
Soil Management (Agron. 8).....	2
Sanitary Science (Vet. Sci. 6).....	2
Feeding Live Stock (An. Ind. 4) ..	3
Advanced Grain Judging (Agron. 5).....	2
Elective .....	6

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18 or 19

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19

## Course in Animal Industry and Dairying

The work in animal industry consists of study in judging, feeding, breeding and caring for farm animals. The work in dairying consists of the handling, manufacture and marketing of milk and its various products.

This course is designed to prepare young men for agricultural college and experiment station work, federal government work, farmers' institute work, positions as buyers and salesmen of livestock, teachers of animal industry and dairying in high schools, managers of large livestock and dairy farms, creamery and dairy inspectors, managers of dairy corporations, and community milk depots; and above all, to furnish men with a scientific as well as a practical knowledge to operate their own farms in Montana.

The first two years of this course are given largely to a study of basic subjects, as English composition, mathematics, physics, chemistry, and biology. The last two years are given to special practical and theoretical work in dairy manufactures, handling of milk, judging and feeding live stock, veterinary science, bacteriology and other allied subjects.

This course is given through text books, lectures, practice and observation. Lectures are given by specialists and the student is made familiar with the most modern ideas and acquainted with the methods of the most successful breeders, feeders and dairymen in this and European countries. The work in judging is given by the use of college animals and stereopticon lectures. To secure a variety of animals, excursions are made to stock farms near the college. Advantage is also taken of the live stock on exhibition at the state and local fairs. Practical instruction is also given in compounding rations, making out pedigrees and keeping breeding records.

The theoretical work in dairying is closely followed with practical work in handling separators, testing milk, ripening and churning cream, and by all the actual work in the college creamery and cheese factory. The practical and theoretical are carefully combined.



## ANIMAL INDUSTRY—DAIRYING.

## JUNIOR YEAR.

## First Semester.

Agricultural Chemistry (Chem. 7)	4
Breeds of Live Stock (An. Ind. 2)	4
Milk and Milk Testing (An. Ind. 9)	3
Bacteriology (Biol. 12)	5
Veterinary Physiology (Vet. Sci. 1)	3
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	19

## Second Semester.

Animal Nutrition (Chem. 11)	3
Poultry (An. Ind. 7)	3
Veterinary Anatomy (Vet. Sci. 2)	3
Vertebrate Zoology (Biol. 2)	4
Organic Evolution (Biol. 14)	2
Dairy Manufactures (An. Ind. 10)	4
or Soil Fertility (Agron. 3)	3
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	18 or 19

## SENIOR YEAR.

Care and Mangement of Live Stock (An. Ind. 6)	3
Obstetrics (Vet. Sci. 4)	3
Stock Judging (An. Ind. 3)	2
Herd Books and Pedigrees (An. Ind. 5)	1
Embryology (Biol. 13)	4
Thesis (An. Ind. 12)	2
Elective	4
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	19

Care and Mangement of Live Stock (An. Ind. 6)	3
Principles of Breeding (Agron. 7)	4
Stock Judging (An. Ind. 3)	2
or Cheese Making (An. Ind. 11)	3
Pathology (Vet. Sci. 3)	3
Feeding of Live Stock (An. Ind. 4)	3
Thesis (An. Ind. 12)	2
Elective	2 or 3
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## Horticulture

The four years' course in horticulture, leading to the degree of Bachelor of Science in horticulture, is designed to prepare students as teachers in agricultural colleges, investigators in the agricultural experiment stations, editors of horticultural papers, managers of fruit associations and superintendents of commercial orchards and fruit plantations. The western United States leads the world in methods of orcharding and disposing of orchard products, and there is a strong and growing demand for persons properly trained to manage the orchard projects now operated throughout the fruit regions of the west. Fruit growing, when done in a scientific way, is extremely profitable and presents an inviting field for the trained horticulturist. The college offers good facilities for a thorough training in all branches of horticulture.

**HORTICULTURE.****JUNIOR YEAR.**

## First Semester.

Economics (Econ. 3).....	2
Soil Physics (Agron. 2).....	5
Bacteriology (Biol. 12) .....	5
Agricultural Chemistry (Chem.	
7) .....	4
Systematic Pomology (Hort. 4)..	3

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## Second Semester.

Economics (Econ. 3).....	3
Soil Fertility (Agron. 3).....	3
Plant Pathology (Biol. 11).....	4
Pomology (Hort. 2).....	3
Organic Evolution (Biol. 14).....	2
Elective .....	3 or 4

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 18 or 19
**SENIOR YEAR.**

General Entomology (Biol. 4)....	4
Greenhouse Construction and	
Management (Hort. 5).....	3
Commercial Fruit Growing	
(Hort. 7) .....	3
Plane Surveying (C. E. 1).....	5
Elective .....	3 or 4

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 18 or 19

Landscape Gardening (Hort. 6)..	3
Vegetable Gardening and Small	
Fruit Culture (Hort. 3).....	5
Principles of Breeding (Agron.	
7) .....	4
Sanitary Science (Vet. Sci. 6)....	2
Elective .....	3 or 4

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 17 or 18

**AGRONOMY.****Professor Atkinson.****Assistant Professor Patterson.****Mr. Bonebright.**

On the main floor of Agricultural Hall are the soil and grain laboratories and class rooms, modern and thoroughly equipped.

The soil laboratory, accommodating forty-eight students, provides for accurate work in soil physics and soil fertility. Upwards of two thousand dollars have been expended in equipping these laboratories with the most up-to-date fittings and apparatus, in order that the students may enjoy the very best facilities.

In the grain laboratory, specially designed individual judging tables have been installed. This permits each student to pursue careful and continuous work in grain judging and enables him to become thoroughly familiar with the various grain standards. Vermin-proof storage cases for class materials and standard samples have been provided. These insure the preservation of valuable material as accumulated. Score cards based on Montana conditions have been prepared for wheat, oats, barley and corn, and are used to impress students with the points to be looked for in grain judging work.

A portion of the space in the greenhouses is given over to pot culture and germination work. Plots on the college farm are available for student work.

(1) **Field Crops.**—A study of grain crops, root crops, sugar, fibre, and other classes of field crops which may be grown in Montana. The history, classification, management, uses and the possible manufactured products are fully discussed. In this course the students become familiar with the various commercial grain standards and have considerable grain judging practice with the score card. Prerequisite: Biology (9) and (10). Lectures, 3; laboratory, 2. I, 5. M. W. F., 9 to 10; T. Th., 8 to 10.

(2) **Soil Physics.**—This course is designed to prepare the students to understand better the effects of the different methods of treating soils, and the influence of these upon moisture, texture, aeration, fertility and production. It comprises a review of the origin, formation and classification of soils and study of the conditions influencing the supply of heat, air and moisture as related to growing plants. The work of the class room is supplemented by laboratory work comprising the determination of such questions as the water-holding capacity and capillary power of various soils, and the effect of mulches and of various systems of rotation on the physical condition of the soil. Prerequisite: Physics (1a); geology (1); chemistry (5). Lectures, 3; laboratory, 2. M. T. Th., 1 to 3.

(3) **Soil Fertility.**—Maintenance of fertility, fertilizers and rotation. The influence of barnyard manure, green manuring and commercial fertilizers upon the quality and yield of the soil and upon succeeding

crops, different rotations and the ultimate effect of different methods of farm management upon the fertility and productive capacity of the soil, and also a study of the preservation of barnyard manure. Prerequisites: Agronomy (2), chemistry (7), biology (12). II, 3. M. W. F., 9 to 10.

(4) **Farm Mechanics.**—Includes the study of the development, construction, functions and methods of operating, adjusting and repairing implements and farm machinery; also a study of the principles of draft and the production of power, and the care and operation of such farm power machinery as the windmill, gasoline engine, and the different makes of traction plowing machinery. Prerequisites: Physics (1a), agronomy (1 and 2). Lectures, 2; laboratory, 1. II, 3. W. F., 10 to 11. Th., 8 to 10.

(5) **Advanced Grain Judging.**—In this course is given constant practice in judging cereal, grass and forage seeds. Prerequisite; Agronomy (1). Laboratory, 2. II, 2. T. Th., 1 to 3:30.

(6) **Farm Management.**—This course considers the problems of farm management. The relative profits of different systems of farm management, the relation of the industry of agriculture to other industries, and the social conditions of agriculture are considered. Prerequisites: Agronomy (1, 2, 3, 4), animal industry (6). I, 4. M. T. W. Th., 11 to 12.

(7) **Principles of Breeding.**—This course considers the different theories of plant and animal improvement, and embraces a study of selection, heredity, variation, atavism and fecundity; also cross breeding and in-breeding with a historical study of their results. Prerequisite; Biology (14). Lectures, 4. II.

(8) **Soil Management.**—This course includes a study of the most approved methods of handling various soils in their relation to crop production. It embraces a study of alkali, sandy, heavy clay, gumbo, muck, peat and old worn-out soils, as well as a study of the management of irrigated and dry farm lands. Prerequisite: Agronomy (1, 2, 3). II, 2. T. Th., 9 to 10.

(9) **Thesis.**—During the senior year, Agronomy students will be allowed four credits if they prepare an acceptable thesis on some subjects to be approved by the head of the Agronomy department. The subject of this thesis must be decided upon no later than November 15th of the senior year, and must include a literature review and some experimental work along the line of the subject chosen. I and II, 4.

#### ANIMAL INDUSTRY AND DAIRYING.

Professor Clark,

Assistant Professor Jones,

Mr. Schoppe,

Mr. Griffin.

For the work in animal industry there is available a herd of thirty-five dairy cows, herds of pure bred cattle, Herefords, Shorthorns, Angus, Holsteins, Ayrshires and Jerseys, Percheron horses, pure bred Berkshire, Poland China and Yorkshire swine, and Shropshire, Rambouillet and



Cotswold sheep. During the winter season the live stock used in the feeding experiments is also available for study. For the poultry work nine breeds of fowls are kept.

The cattle barn is a two-story frame building with two wings extending to the south. One of these wings is used for the dairy cows and breeding stock, and the other for bulls, young stock and calves. Between these two rooms is located a stock judging pavilion forty feet square. The second story of the main barn is used for the storage of hay. The first story provides feeding rooms, storage for grain and box stalls.

The horse barn is a two-story frame building with stalls for twelve horses, carriage and feed rooms, and capacity of 100 tons of hay.

The piggery consists of a main building thirty by thirty-five feet, with two wings sixteen by fifty feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each.

The poultry buildings include two main buildings, one seventy-two by sixteen feet, with twelve pens; the other one hundred and twenty-eight feet long with eight pens; with yards one hundred feet long on either side, and a brooder house thirty-six by sixteen feet. These buildings are connected by a feed room, fourteen by twenty feet, under which is an incubator cellar and a heating plant for the building.

The dairy is equipped with all modern appliances for the manufacture of butter and cheese. Eight hand separators afford the students an opportunity to compare the merits and demerits of the different types.

In churns there are the Perfection, Disbrow and Simplex. These are all combined churns and butter workers, yet are entirely different in style. In addition, the butter room is equipped with all modern appliances for handling milk and cream, such as cream vats, tempering vats, Wizard and Jensen ripeners, starter cans, and Bohn refrigerator, together with all things necessary for the manufacture of butter in an up-to-date plant.

The creamery is equipped with a five-horsepower boiler and a five-horsepower electric motor, and in the practical work each student takes his turn in handling these machines.

The cheese room is 30 by 30 feet, with curing rooms 20 by 20 feet; in the former there are cheese vats, gang and upright presses and all necessary hoops and equipment for the manufacture of all varieties of American Cheddar cheese. In this department there is made both Edam and Brick cheese, but special emphasis is placed on the manufacture of the American cheese.

The testing laboratory is very thoroughly equipped with different styles of Babcock testers (both hand and steam) and all necessary glassware for the testing of milk, cream, butter, cheese, skim milk, whey, etc.

Different tests for the determination of moisture in butter have been added as well as a complete equipment for acidimetry.

(1) **Animal Types.**—A study of types as related to production and work. This course covers the judging of the different market classes of

cattle (beef and dairy), of sheep (mutton and wool), of horses (light and heavy), and of hogs (bacon and fat). The entire time of this course is given to practical handling and judging of the stock in the stock pavilion. Laboratory, 3. II, 3. T. W. Th., 1 to 3:30.

(2) **Breeds of Live Stock.**—A study of the development of the breeds of horses, cattle, swine and sheep will illustrate the principles and particular characteristics, and distinguish one breed from another, and will show the adaptability of each particular breed to various climates, conditions and purposes. These lectures will be illustrated by stereopticon views of characteristic animals of the different breeds. Lectures, 3; laboratory, 1. I, 4. M., 11 to 12; T. Th., 10 to 11; Th., 1 to 3:30.

(3) **Stock Judging.**—Animal measurements and the systematic study of animal form, function, and performance; the aim being to give exact and intimate acquaintance with the detailed form of specialized types, a knowledge that is essential to the highest success in selection and breeding; also some systematic work in the judging of groups of cattle, horses, sheep and swine, similar to those found at county and state fairs. Lecture, 1; laboratory, 1. I and II, 4.

(4) **Feeding Live Stock.**—The principles underlying the profitable feeding of animals. The composition of plants, animals and animal products. The practice that gives best results as indicated by available data gathered from the work of experiment stations in this and other countries. II, 3.

(5) **Herd Books and Pedigrees.**—This is largely a laboratory study of the herd books of different breeds of live stock. The tabulation of pedigrees is practiced, and such other exercises as will enable the student to learn the value of a pedigree and show how to keep the record of a breeding herd. I, 1.

(6) **Care and Management of Live Stock.**—A special study of the methods to be followed in the breeding, feeding and development of the various classes of live stock as illustrated from the practices of the most successful stock breeders. Lectures, 2; laboratory, 1. I and II, 6. T. Th., 9 to 10; M., 1 to 3:30.

(7) **Poultry.**—Breeds and management; poultry houses; feeding and care of poultry; the operation of incubators and brooders. II, 3.

(8) **Farm Dairying.**—This course comprises a study of the subject of dairying and its general relation to the farm. The class of work takes up production of milk, separation of cream by gravity and separator; the preparation of starters; the ripening and churning of cream; the packing and marketing of butter. The use of the Babcock tester is also discussed, with particular reference to its use on the farm; also the construction of the milk house and stables, with regard to sanitary conditions as well as to utility. Lectures, 2; laboratory, 1. I, 3.

(9) **Milk and Milk Testing.**—This course comprises a study of milk, its secretion, composition, and uses; pasteurization; separation and handling for city milk trade; the care of milk for creamery or cheese factory;

the testing of variations and adulterations; the testing of butter and cheese; and the use of the acidimeter. Reference books used: *Milk and Milk Testing*, by Farrington & Wall; *Modern Methods of Testing Milk and Its Products*, by Van Slyke; and *Dairy Laboratory Guide*, by Melick. Lectures, 2; laboratory, 1. I, 3. M. W., 9 to 10. M., 1 to 3:30.

(10) **Dairy Manufactures.**—This course comprises advanced work in butter making, the scoring of butter and cheese, factory management and accounting, milk inspection, and the preparation of ice cream and ices.

This course is also intended to give the student a general knowledge of the different ways in which milk and its products are utilized outside of the scope ordinarily considered under dairying; such subjects as the preparation of condensed, certified, modified, and hygienic milk. Reference books used: *The Principles and Practices of Butter Making*, by McKay and Larson; and *Jensen's Milk Hygiene*, by Pearson. Lectures, 1; laboratory, 3. II, 4.

(11) **Cheese Making.**—The equipment for factory and home cheese making, the principles and practice necessary to make a uniform article and methods used to overcome characteristic difficulties are explained and illustrated in the class room and laboratory. All common varieties of cheese, such as Cheddar, Swiss, Brick and Limburger, are discussed, and as far as possible made in the cheese room, but the Cheddar cheese making is particularly emphasized. Reference books: *Cheese Making*, by Decker; and *The Science and Practice of Cheese Making*, by Van Slyke & Publow. Laboratory, 3. II, 3.

(12) **Thesis.**—During the senior year each student is required to prepare a thesis. This must be original work by the student, who must consult with the instructor in charge regarding subject. I and II, 4.

Professor Whipple.

Mr. Schermerhorn.

(1) **Principles of Plant Culture.**—A course designed for all students in agriculture and others interested in the subject of plant production. The time is given largely to the study of the principles and practice of plant propagation, including practical work on the propagation of plants by spores, seeds, cuttings, layers, graftage and other methods of lesser importance; methods of gathering and storing seeds and their influence upon germination; transplanting, principles, methods and influence upon the growth of plants. Prerequisite: Biology (9). Lectures, 2; laboratory, 1. II, 3.

(2) **Pomology.**—This course is designed for horticulture students, and deals with the principles and practice of pruning tree-fruits, grapes and small fruits; the physiology of pruning; the fruit bearing habits of plants and their relation to pruning; the effect of ringing, bending and thinning fruit; pruning young trees, dwarf trees and mature trees—these subjects will be treated in text book, lectures and practice work. Prerequisites: Hort. (1), Biol. (10). II, 3.

(3) **Vegetable Gardening and Small Fruit Culture.**—This course deals with the principles of vegetable gardening and small fruit culture, as well as with the practical side of the subjects. The growing of vegetables in the garden and greenhouse will be discussed. The growing of small fruits adapted to Montana conditions will be taken up in detail. The subjects will be treated in text book, lectures and practice work. Prerequisites: Hort. (1), Biol. (10), Agron. (2). II, 5. M. T. W. Th. F., 9 to 10.

(4) **Systematic Pomology.**—This course takes up the systematic side of pomology, the description and naming of varieties of fruit. Considerable time will also be devoted to the judging of exhibition fruit and discussion of score cards. The latter part of the course will be devoted to a study of the evolution of cultivated plants, especially fruits. Prerequisites: Hort. (1), Biol. (9). Lectures, 2; laboratory, 1. I, 3.

(5) **Green House Construction and Management.**—The construction, heating and maintaining of greenhouses, with lectures and practice treating of the methods of growing plants in greenhouses and conservatories. Prerequisites: Hort. (1), Agron. (2) and (3). I, 3.

(6) **Landscape Gardening.**—The laying out and planting of private and public grounds are discussed. The trees, shrubs and flowers suited to Montana conditions are studied. Lectures, 2; laboratory, 1. II, 3.

(7) **Commercial Fruit Growing.**—In this course the methods of planting, cultivating, irrigating and managing commercial orchards are discussed in the class room and orchard. The methods of picking, grading, packing and marketing fruits are important phases of the course. Prerequisites: Hort. (1), (2) and (4), Agron. (2) and (3). Lectures, 2; laboratory, 1. I, 3. T. Th., 8 to 9.

(8) **Thesis.**—Horticultural students may elect to prepare during the senior year a thesis, the subject of which must be approved by the head of the Department of Horticulture. The number of credits to be allowed for such work will be determined by the head of the horticultural department and the instructor under whom the work is selected.

## VETERINARY SCIENCE.

Dr. Taylor.

(1) **Veterinary Physiology.**—A course in animal physiology dealing with the prehension of foods as observed in the various domestic animals. Also the digestion, assimilation and uses of the various foods, the circulation of the blood and its function, the nervous system, the sense of sight and the phenomenon of locomotion. Prerequisite: Biology (3). Text book, *A Manual of Veterinary Physiology*, by Captain F. Smith, I, 3.

(2) **Anatomy.**—Lectures and laboratory work dealing with the bony framework of the body and its muscles. Special emphasis is laid upon a thorough study of the thoracic and abdominal organs and organs of reproduction. Prerequisite: Veterinary Science (1). Text book: *Chauveau's Comparative Anatomy of the Domesticated Animals*. II, 3.

(3) **Pathology.**—This course is designed to make the student familiar with the normal and pathological tissues. Gross and microscopical specimens will be used for demonstration. Prerequisite: Vet. Sci. (2). II, 3.

(4) **Obstetrics.**—Diseases of animals incident to reproduction. Emphasis will be put especially upon normal presentations and reduction of dystokia. Prerequisite: Veterinary Science (2). Text book: Williams's Veterinary Obstetrics. I, 3.

(5) **Materia Medica.**—A comprehensive study of the combination of the more common drugs in the treatment of farm animals. Prerequisite: Biology (9). I, 2.

(6) **Sanitary Science.**—This course deals with the care and handling of animals affected with communicable diseases. It will also include a few lectures upon sanitary police, or interstate shipment, and on farm sanitation. Text book: Law's Veterinary Medicine, Vol. IV. II, 2. T. Th., 10 to 11.

(7) **Common Diseases of Animals.**—On the causes, prevention and treatment of the more common diseases of animals. II, 3.



## Division of Engineering

The purpose of the courses offered in the division of engineering is to furnish the student the fundamental training essential to a successful engineer. This result is accomplished, not alone by the study of the theory, but by the practical application of the principles involved. A limited degree of flexibility is given in some of the courses through electives, thus enabling the student to specialize in a chosen line of work.

Courses are offered in civil engineering, electrical engineering and mechanical engineering, leading respectively to the degree of Bachelor of Science in civil, electrical and mechanical engineering, and post graduate courses leading respectively to the degree of Civil Engineer, Electrical Engineer and Mechanical Engineer.

One of the largest and most remunerative fields of work in Montana is that for the irrigation engineer and irrigation manager. Students who are preparing for this kind of work will elect Field Crops (Agronomy 1), Soil Physics (Agronomy 2), Soil Fertility (Agronomy 3), Soil Management (Agronomy 8), and Geology 1.

## Civil Engineering

This course is designed to prepare the student to practice the profession of civil engineering in its following branches: Structural and architectural engineering; street, highway and railway engineering; water power development; irrigation, drainage and water supply engineering; city engineering; sanitary engineering; plotting, mapping, surveying, etc. The technical subjects which give proficiency in the above branches are supplemented by a thorough study of capital, labor and labor organizations, banking, cost, cost keeping, contracts, specifications, and other legal phases of engineering. Consequently the graduate is enabled to gain compensation, not only through wages and fees, but also as an engineering promoter, as a contractor, or as a consulting engineer.

A student who desires to specialize in architecture, or in sanitary science, is allowed to so arrange his electives that he may graduate as an architectural engineer, or as a sanitary engineer.

All civil engineering students will take the sub-courses listed on page 41. In addition to these subjects, the regular student will take Math. (5) and (6); Geol. (1); C. E. (4), (7), (11), (17), (24) and (25); the student of architecture will take art (3) and (7); Hort. (6); C. E. (32), (33), (34), (35) and (36); and the student of sanitary engineering will take Biol. (9) and (12); Chem. (3), (4), (5) and (10); and C. E. (33).

Each student is expected to engage in practical engineering work during his summer vacations, and is assisted in securing such positions as he may be able to fill.

# CIVIL ENGINEERING.

## FRESHMAN YEAR.

### First Semester.

English Composition (Eng. 1)....	1
Algebra (Math. 1).....	3
Trigonometry (Math. 2) .....	2
General Chemistry* (Chem. 1)....	4
Elementary Drawing (C. E. 2)....	3
Public Speaking (Eng. 4).....	1
Woodwork† (M. E. 2) .....	2
Foundry† (M. E. 4) .....	1
Military Drill .....	1

19

### Second Semester.

English Composition (Eng. 1).....	2
Analytical Geometry (Math. 3)..	4
Descriptive Geometry (M. E. 3)	5
General Chemistry* (Chem. 1)....	4
Public Speaking (Eng. 4).....	1
Concrete and Cement (C. E. 15)..	2
Military Drill .....	1

19

## SOPHOMORE YEAR.

English Composition (Eng. 2)....	2
Calculus (Math. 4) .....	5
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2) .....	2
Plane Surveying (C. E. 5).....	5
Elective .....	2
Military Drill .....	1

20

Calculus (Math. 4).....	5
Electrical Machinery (E. E. 1)....	2
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2) .....	2
Elective .....	6
Military Drill .....	1

19

## JUNIOR YEAR.

Mechanics (C. E. 5).....	4
Hydraulics (C. E. 8).....	3
Irrigation Engineering (C. E. 9)	3
Seminar (C. E. 12).....	1
Elective .....	8 or 9

Mechanics (C. E. 5).....	4
Strength of Materials (M. E. 14) .....	1
Structural Engineering (C. E. 13) .....	5
Sanitary Engineering (C. E. 14)	3
Contracts and Specifications (C. E. 23).....	2
Seminar (C. E. 12).....	1
Elective .....	3

19 or 20

19

## SENIOR YEAR.

Economics (Econ. 3).....	2
Water Power Dev. (C. E. 18).....	3
Engineering Design (C. E. 19)....	3
Found. and Masonry (C. E. 21)..	3
Seminar (C. E. 1).....	1
Elective .....	7

19

Economics (Econ. 3).....	2
Municipal Engineering (C. E. 19)	3
Engineering Design (C. E. 19)....	3
Seminar (C. E. 12).....	1
Thesis (C. E. 27).....	5
Elective .....	5

19

\*Foreign language for students of architectural engineering.

†Or 3 credits of architectural drafting.

## Electrical Engineering

This course provides a thorough technical training in electrical engineering. The rapid development of electrical engineering is largely due to the use of sound theory in the solution of commercial problems. For this reason the theoretical subjects, and the application of theory to the solution of practical problems are emphasized.

The course is designed to teach students the scientific laws and principles forming the basis of the profession, and the application of these laws and principles to commercial problems. The general training consists of courses in mathematics, physics, chemistry, drawing and shop work. The electro-technical work consists of lectures and recitations on the theory of electrical phenomena, and on problems in the design, construction and operation of electrical machines and apparatus. Conventional methods are used in drawing and designing, and the experimental tests made in the laboratory are essentially similar to the tests made by large manufacturing companies. The apparatus and instruments used are of modern commercial types.

A limited number of electives is offered during the sophomore, junior and senior years. Students may choose their electives by consultation with the head of the department.

The course is supplemented by an annual inspection trip to some of the large power plants of Montana, and by lectures by prominent electrical engineers.

**ELECTRICAL ENGINEERING.****FRESHMAN YEAR.**

## First Semester.

English Composition (Eng. 1)....	2
Algebra (Math. 1).....	3
Trigonometry (Math. 2).....	2
Public Speaking (Eng. 4).....	1
General Chemistry (Chem. 1).....	4
Elementary Drawing (E. E. 21) 3	
Forge Work (M. E. 6).....	3
Military Drill .....	1

19

## Second Semester.

English Composition (Eng. 1)....	2
Analytical Geometry (Math. 3)..	4
Descriptive Geometry (M. E. 3)	5
Public Speaking (Eng. 4).....	1
General Chemistry (Chem. 1).....	4
Foundry (M. E. 4a) .....	1
Woodwork (M. E. 2).....	2
Military Drill .....	1

20

**SOPHOMORE YEAR.**

Expository Composition (Eng. 2)	2
Calculus (Math. 4).....	5
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2)	2
Military Drill .....	1
Elective.....	4 to 5

17 to 18

Calculus (Math. 4).....	5
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2)	2
Electrical Machinery (E. E. 1)....	2
Dynamo Drawing (E. E. 2).....	2
Military Drill .....	1
Elective.....	2 to 4

17 to 19

**JUNIOR YEAR.**

Mechanics (C. E. 5).....	4
Dynamos and Motors (E. E. 3)....	3
Electricity and Mag. (Phys. 5)....	4
Electrical Diagrams (E. E. 7).....	2
Electrical Lab. (E. E. 4).....	2
Seminar (E. E. 17).....	1
Elective.....	2 or 3

18 or 19

Mechanics (C. E. 5).....	4
Applied Electricity (E. E. 5).....	4
Dynamo Design (E. E. 8).....	3
Strength of Materials (M. E. 14)	1
Electrical Lab. (E. E. 6).....	2
Seminar (E. E. 17).....	1
Elective.....	2 to 4

17 to 19

**SENIOR YEAR.**

Economics (Econ. 3).....	2
Alternating Currents (E. E. 11)	4
Electrical Design (E. E. 16).....	3
Contracts and Specifications (E. E. 14)	1
Electrical Lab. (E. E. 12).....	2
Seminar (E. E. 17).....	1
Thesis (E. E. 20).....	3
Elective.....	2 or 3

18 or 19

Economics (Econ. 3).....	2
Alternating Currents (E. E. 9)....	4
Electrical Design (E. E. 13).....	3
Power Plant Practice (M. E. 16)	1
Electrical Lab. (E. E. 10).....	3
Seminar (E. E. 17).....	1
Thesis (E. E. 20).....	2
Elective.....	2 or 3

18 or 19



## Mechanical Engineering

\* The purpose of the course in mechanical engineering is to fit its graduates for successfully filling responsible positions as supervising and designing engineers. It furnishes fundamental training in the science, the art and the business of engineering, and prepares for the design, operation, superintendence and management of power plants, heating plants, refrigerating plants, lighting plants, pumping plants, and of the mechanical equipment of mines and railroads; and for the design, manufacture, installation, testing and operation of shop and laboratory machinery, steam and gas engines, and auxiliary equipment.

The course comprises four years' instruction and training by text book, lecture, laboratory and shop practice, based on mathematics, physics, chemistry, mechanics, machine design, structural design and thermodynamics. It is designed to give the student a thorough knowledge of the basic principles of his profession and such technical skill as the application of theoretical principles in every day practice in shop and laboratory will insure. The work of each department—class room, laboratory, shop and designing room—is made to supplement the work of each of the others, thus giving a balance in the technical equipment of the young engineer obtainable in no other way.

# MECHANICAL ENGINEERING.

## FRESHMAN YEAR.

### First Semester.

English Composition (Eng. 1)....	2
Algebra (Math. 1).....	3
Trigonometry (Math. 2).....	2
General Chemistry (Chem. 1).....	4
Public Speaking (Eng. 4).....	1
Mechanical Drawing (M. E. 1)....	3
Forge Work (M. E. 6).....	3
Military Drill .....	1

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19

### Second Semester.

English Composition (Eng. 1).....	2
Analytical Geometry (Math. 3)..	4
Descriptive Geometry (M. E. 3)	5
General Chemistry (Chem. 1).....	4
Public Speaking (Eng. 4).....	1
Wood Work (M. E. 2).....	2
Foundry (M. E. 4).....	1
Military Drill .....	1

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20

## SOPHOMORE YEAR.

Expository Composition (Eng. 2)	2
Calculus (Math. 4).....	5
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2)	2
Mechanism (M. E. 5).....	4
Pattern Work (M. E. 2a).....	2
Foundry (M. E. 4a).....	1
Military Drill .....	1

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20

Expository Composition (Eng. 2)	2
Calculus (Math. 4).....	5
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2)	2
Electrical Machinery (E. E. 1)....	2
Mechanism (M. E. 8).....	4
Military Drill .....	1

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19

## JUNIOR YEAR.

Mechanics (C. E. 5).....	4
Steam Engineering (M. E. 7).....	3
Valve Gears (M. E. 10).....	2
Electricity and Magnetism (Phys. 5) .....	4
Hydraulics (C. E. 8).....	3
Machine Tool Work (M. E. 17)..	2
Power Plant Practice (M. E. 16)	1

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19

Mechanics (C. E. 5).....	4
Thermodynamics (M. E. 18).....	5
Machine Design (M. E. 13).....	6
Mechanical Laboratory (M. E. 15a) .....	1
Strength of Materials (M. E. 14)	1
Machine-Tool Work (M. E. 21)....	2

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19

## SENIOR YEAR.

Economics (Econ. 3) .....	2
Steam and Gas Engineering (M. E. 22) .....	3
Machine Design (M. E. 23).....	4
Steam and Gas Laboratory (M. E. 20) .....	2
Dynamos and Motors (E. E. 3)..	3
Electrical Laboratory (E. E. 4)..	2
Seminar (M. E. 11).....	1
Machine-Tool Work (M. E. 27)....	2

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19

Economics (Econ. 3) .....	2
Plant Design (M. E. 29).....	5
Engineering Laboratory (M. E. 28) .....	2
Industrial Engineering (M. E. 25) .....	2
Seminar (M. E. 11).....	1
Elective.....	2 to 3
Thesis (M. E. 30).....	4

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18 to 19

**CIVIL ENGINEERING.****Professor Kneale.****Assistant Professor Snow.**

The equipment of this department consists of transits, solar attachments, precision levels, hand levels, engineers' wye and dumpy levels, plane tables, alidades, declinators, tachymeters, theodolite, sextant and horizon, reflectoscope and lantern, aneroids, engineers' compass, current meters, tide gauge, automatic water registers, model flumes, etc., odometer, vicat needle, Gilmore needles, briquelette machines and molds, weir measuring devices, specific gravity apparatus, fineness scales, polar and rolling planimeters, level and stadia rods, chains, tapes, drafting instruments, blue printing apparatus, complete photographic outfit, complete laboratory and drafting rooms well supplied with necessary equipment.

The department is quartered in eight rooms which include drafting rooms, seminar room, photographic dark room, cement laboratories, office, instrument room and lecture room.

(1) **Plane Surveying.**—The theory and practice of plane surveying, including the elementary principles, the use and adjustment of field and office instruments, the methods of field, topographic, hydrographic, mine and city surveying; barometric and spirit leveling, and the computation of earth work. Prerequisites: Mathematics up to and including trigonometry. Texts: Theory and Practice of Surveying, by Johnston; Manual of Surveying, by Pence & Ketchum. Lectures, 3; laboratory, 2. I, 5. M. T. Th., 11 to 12; M. W., 1 to 3:30.

(2) **Elementary Drawing.**—This course is designed to teach the student the use of draughting instruments in topography, projection, isometric drawing, mapping, sketching and lettering; the principles of perspective; and tracing and blue printing. Owing to the demand for topographical draughtsmen the course has been extended through the second semester for all students desiring to become especially proficient, and is elective to all students completing the first semester's work. Before beginning work the student will provide himself with one of the following sets of instruments or with a set of equal quality: K. & E. No. 896 NCP with No. 523½ pen, or Dietzgen No. 937 C with No. 508 pen.

(3) **Municipal Engineering.**—This course is given to cover such problems of city engineering as are not studied in the course in Sanitary Engineering. Particular attention is given to city planning; allotting and platting additions; disposal of refuse; construction of streets, sidewalks, curbs, and gutters; to parks and parkings; and to the laws affecting the work of the city engineer. Prerequisites: C. E. (1), (2), and (4). Text: Baker's Roads & Pavements. Lectures, 3. IIS, M. T. Th., 8 to 9.

(4) **Railroad Engineering.**—Railroad reconnoissance, preliminary and location surveys. Theory and practice in laying out railroad structures, simple and compound curves, easements and transition spirals, simple and compensated grades, switches, turnouts and crossings. The making and use of mass diagrams, profiles, field maps, cross sections, etc. Calculations of yardage in embankments, excavations and borrow pits. Complete map of location survey for short line of railroad. Prerequisite: C. E. (1). Texts: Searle's Field Engineering. Webb's Railroad Construction. Lectures, 4; laboratory, 2. II. 6. M. T. W. Th., 11 to 12; M. W., 1 to 3:30.

(5) **Mechanics.**—Forces and equivalence of force systems, center of gravity and centroids, attraction, stress, strain, principle of equilibrium, rectilinear and curvilinear motion, translation, work and energy, impulse, impact, momentum, second moments, vectors, materials of engineering and testing machines, elastic and ultimate deformation, theory of beams, columns and shafts, apparent and combined stresses, resilience, fatigue, least work, true internal stresses, riveting and friction. Texts: Maurer's Technical Mechanics, and Merriman's Mechanics of Materials. Lectures, 4. I and II, 8. M. T. W. Th., 9 to 10.

(7) **Highway Engineering.**—Location, construction, and maintenance of highways. Water, salts, emulsions, tars, and bitumens as binders and dust preventatives. Tests of highway materials. Traffic data in relation to type of road. Methods of drainage, including types of culverts and area of water way. Patented types. Federal, state, and county aid. Highway laws. A study of traction, sanitation, radiation of light and heat, slipperiness, ease of cleaning, repairing, etc. Text: Byrne's Highway Construction. Lectures, 2. I, 1. T. Th., 10 to 11.

(8) **Hydraulics.**—Theoretical hydraulics, hydraulic measurements; flow of water through orifices, over weirs, through pipes, conduits, and canals. Text: Merriman's Hydraulics. Prerequisites: Mathematics to and including calculus, physics (1) and (2). Lectures, 3. M. T. W., 11 to 12.

(9) **Irrigation Engineering.**—This course includes a study of the principles of impounding, diverting, conveying and measuring water; a study of the structures required in irrigation systems such as flumes, siphons, head gates, weirs, diversion works, and the various types of dams; a study of the problems of seepage and drainage in their relation to irrigation and reclamation, a sufficient study of steam, gasoline and wind driven pumps, and pump types, to enable the student to select the most efficient device for raising water for service in irrigation. The problems of cost are also taken up. Prerequisites: C. E. (1) and C. E. (4). Hydraulics must be taken in connection with the subject. Text: Irrigation Engineering, by Wilson. Lectures, 3. I, 3. M. T. Th., 10 to 11.

(11) **Field Practice.**—Practice in the use of engineering instruments on the more difficult problems of civil engineering. The work is designed to develop speed and accuracy. Photography is applied to making surveys and reports. Prerequisites: C. E. (1) and (4), and Chem. (1). Laboratory, 4. I, 4. M. T. W. Th., 1 to 3:30.

(12) **Seminar.**—The junior and the senior students and the instructors of the department meet once a week to discuss the more important problems of the engineering profession. At the beginning of the semester the names of the students are placed in order for the year's work, and the work is assigned in the following sequence: Speaker, chairman, secretary. The speaker delivers a thirty minute lecture on some engineering topic selected with the advice of an instructor. The lecture is followed by a general discussion of the subject. The secretary reports an abstract of the meeting at the next session, and the chairman presides and conducts the seminar according to the best parliamentary procedure. Extemporaneous speeches on engineering topics are required as tests. By means of the reflectroscope the student is enabled to illustrate his lectures. Lectures, 1. I and II., 2. F., 9 to 10.

(13) **Structural Engineering.**—Theory and practice in the analytic and graphic calculation of stresses in simple structures. The structures studied will include the principal types of railroad and highway bridges; roof trusses, steel buildings; trestles; standpipes; reinforced concrete, etc. The laboratory periods are given to the preparation of complete working drawings and erection sheets for as many typical structures as possible. Prerequisites: C. E. (5). Text: Roofs and Bridges, part II, Merriman & Jacoby. Reference text: Theory of Modern Framed Structures, by Johnson, Bryan & Turneure. Lectures, 1. Laboratory, 4. II, 5. M. Tu. W. Th., 1 to 3:30. M., 3:30 to 4:30.

(14) **Sanitary Engineering.**—Collection, purification and distribution of water; systems of water supply and sewerage; disposal of sewage; house drainage; sanitary inspection. Text: Folwell's Sewerage, and Turneure & Russell's Water Supplies. Prerequisites: C. E. (4, 5, 6), (8 and 9). Lectures, 3. II, 3. M. T. Th. F., 10 to 11.

(15) **Concrete and Cement.**—A study of the physical properties, processes of manufacture, and chemical composition of commercial cements. Standard commercial tests and interpretation of results. A study of the uses, proportions, methods of mixing and placing of cement-mortar. Standard types of plain concrete structures. Text: Plain and Reinforced Concrete, by Taylor & Thompson. Laboratory, 2. II, 2. T. Th., 1 to 3:30.

(17) **Geodesy.**—Elements of geodesy. Base line measurements, triangulation, balancing surveys and distributing errors, application of method of least squares, principles of map projections, tests and investi-



gations. Text: Johnson's Theory and Practice of Plane Surveying. Lectures, 1. Laboratory, 2. II, 3. W., 9 to 10. T. Th., 1 to 3:30.

(18) **Water Power Development.**—A course in the development of water power. The design and use of the turbine, impulse and other forms of water motors. The design and construction of headraces, spillways, etc. The class will be required, whenever possible, to examine water powers, and report upon the design and method of development. Considerable time will be devoted to the description of recently installed plants as published in the engineering journals. Text: Merriman's Hydraulics. Reference: Church's Hydraulic Motors. Prerequisites: C. E. (1), (5, 8). Lectures, 3. I, 3. M. W. F., 10 to 11.

(19) **Engineering Design.**—This course is devoted to the design of engineering works, maps, etc. Laboratory, 3. I, II, 6. T. Th. F., 1 to 3:30.

(21) **Foundations and Masonry.**—This course includes a study of materials and methods employed in the construction of piers, abutments, masonry dams, retaining walls and foundations; economy of construction; strength of joined materials; composition of different kinds of mortar. Text: Baker's Foundations and Masonry. Lectures, 3. I, 3. M. T. Th., 8 to 9.

(23) **Contracts and Specifications.**—The elementary law of contracts and its application to engineering considered, together with the correct form of specifications and the judicial interpretation placed on the technical terms commonly used in engineering specifications. Text: Johnson's Contracts and Specifications. Elective to all engineering students after the sophomore year. Lectures, 2. II, 2. T. Th., 9 to 10.

(24) **Practical Astronomy.**—A course in astronomy designed to meet the needs of the civil engineer. A considerable portion of the time is given to day and night astronomical observations. Text: Comstock's Field Astronomy. Prerequisite: Mathematics (6). Laboratory, 2. II, 2.

(25) **Cost of Construction.**—This course is designed to acquaint the student with the cost of labor and materials used in engineering construction; to point out the necessity and methods of keeping accurate records of the cost of proposed engineering surveys, and construction work. Text: Gillette's Cost Data. Prerequisites: C. E. (1, 1a, 4, 5, 8), (13). Lectures, 2. I, 2. T. Th., 10 to 11.

(27) **Thesis.**—The student will be required before graduation to present a suitable thesis upon some engineering subject in the line of his course. A copy of the same, together with all original maps, tables, etc., typewritten, bound, and upon specified paper, will be filed with the college and become its property. The student is required to select his subject at the beginning of the senior year. 5, II.

(32) **Concrete Construction.**—Advanced concrete design, together

with a study of surfaces, waterproofing, concrete and cement machinery, etc. Prerequisites: C. E. (15), and the first semester of C. E. (5). Lectures, 1; laboratory, 2. II, 3.

(33) **Sanitary Construction.**—Plumbing, trap ventilation; removal of waste, construction of water closets, drains and systems of water supply; sewage disposal; sanitary fixtures. Text: Cosgrove's Principles and Practice of Plumbing. Lectures, 2. I, 2.

(34) **Wood Construction.**—The growth, cutting, seasoning, working, and finishing of woods; structural and decorative properties; use of wood in buildings; detailing walls, roofs, floors, windows, doors, cornices, stairs, wainscoting, cabinet work, and interior finish. Text: Kidder's Building Construction, part I. Lectures, 1; laboratory, 2. II, 3.

(35) **History of Architecture.**—History of ancient, medieval, and modern architecture. Particular attention is given to the structural as well as the artistic characteristics of the different styles. The student thus obtains a knowledge of the general design as well as the details of the world's buildings. Lectures, 4. I and II, 8.

(36) **Heating and Ventilation.**—The course is designed to give the student facility in designing and superintending the erection of heating and ventilating plants in such buildings as he may design or erect. Text: Hoffman's Heating and Ventilation. Lectures, 3. I, 3.

## ELECTRICAL ENGINEERING.

Professor Thaler.

Mr. Haines.

The electrical engineering department occupies a two story stone building and the second floor of a frame building. The electrical laboratory is located on the first floor. The second floors contain class rooms and drafting rooms, a photometer room, a battery room, and a high tension room.

The equipment of the electrical laboratory is very complete, with apparatus of modern type. There are two double current multipolar generators, capacity 15 K. W. These machines may be driven by the 40 H. P. engine or by the laboratory motor, and may be used as direct current dynamos, as alternators, single, two or three phase; as synchronous motors or as rotary converters.

The two machines are also used for practice in synchronizing, and furnish alternating current for the induction motors, and for the mercury arc rectifier. For direct current work the laboratory contains in addition to the two generators, one Excelsior 15 light arc dynamo, connected to eight series-arc-lamps, arranged for testing purposes; one 15 H. P. Northern Electric company motor; and one 10 H. P. Siemens and Halske motor. Each motor is provided with a friction brake and other auxiliary appar-

atus for complete tests of the armature and field resistance, of the magnetic distribution and leakage, and of the efficiency and regulation at different loads; one 6 K. W. Excelsior dynamo may be used as either a shunt or a compound machine, and is driven by the 10 H. P. motor and arranged for testing purposes.

For alternating current work the laboratory contains, in addition to the two generators, one mercury arc rectifier, capacity 30 amperes at 110 volts; one 2 H. P. single phase Westinghouse induction motor with phase splitter, provided with a prony friction brake for efficiency and regulation tests at different frequencies and at different voltages; one 6 H. P. three phase General Electric Co. induction motor, also provided with auxiliary apparatus for testing purposes.

A 150,000 volt testing transformer is used to test insulators for high tension transmission, and to test the insulation resistance of insulating materials.

Seven transformers, six single phase and one three phase, capacities from 1 to  $1\frac{1}{2}$  K. W., are available for testing purposes, and for practice in making transformer connections.

A General Electric Co. Oscillograph, with photometric and tracing table attachments, is provided for investigating the wave forms of alternating and oscillatory electro-motive forces and currents.

For general testing the laboratory contains one stationary lamp bank of 136 incandescent lamps, with a current capacity of 130 amperes at 110 volts; the lamps are arranged so that the current can be regulated within a small fraction of one ampere; four portable lamp banks of ten lamps each, arranged so that the lamps can be connected either in series or in parallel; one 900 Ohm iron wire resistance and five iron wire resistances for heavy currents, besides a number of rheostats, switches and current breakers.

The laboratory contains twenty-nine electrical measuring instruments, including nine voltmeters; one Whitney 150-300 volts; one Whitney 15 volts; one Weston 150 volts; one Weston milli-meter; one Weston 75-150 volt A. C.; one Westinghouse 150 volt switchboard voltmeter.

There are eight portable ammeters; one 5 ampere D. C. Weston, three Whitney ammeters, capacity 10, 25 and 50 amperes, D. C., respectively; two Hoyt's A. C. ammeters, 10 and 30 amperes respectively; one G. E. ammeter with series transformer, 120 amperes A. C., and one Westinghouse, 120 amperes.

The department has four portable wattmeters; one Westinghouse, with series transformer, capacity 100 amperes at 200 volts; one Hoyt, capacity 1,500 K. W., one Weston, with multiplier, 2 amperes at 2,250 volts; one G. E. Co. wattmeter, capacity 10,000 watts.

The apparatus for calibrating instruments consists of one Leeds

potentiometer with standard cell and standard resistance, one Kelvin standard watt balance, one Westinghouse precision voltmeter and one Westinghouse precision wattmeter.

One mercury vapor lamp, 15 arc lamps, series, constant potential, alternating and direct current, Tungsten, Tantalum and Nernst lamps are available for testing purposes.

In the photometer room is a Willyoung station photometer with universal rotator and bunsen screen for testing the candle power, distribution of light, and the efficiency of incandescent lamps.

The battery room contains a storage battery of 56 cells at 60 ampere hours capacity, of the following types: 10 chloride accumulators, 10 National Battery Co.'s unit accumulator, 10 Willard cells and 26 American cells. The batteries furnish current for calibrating instruments and are also available for testing purposes.

A Wireless Telegraph Station has been installed during the past year. The equipment consists of a 5 K. W. sending set, a 350-foot 4-strand aerial and a receiving set with a range of 1,200 miles.

Before beginning work a student must provide himself with one of the following sets of drawing instruments or a set of equal quality: K. & E. No. 896 NCP with No. 523½ pen, or Dietzgen No. 937 C with No. 508 pen.

(1) **Electrical Machinery.**—Lectures on the construction, care and operation of commercial electrical machines and apparatus, including batteries, electric lights, dynamos, motors, alternators, transformers and electrical measuring instruments. Text: Introduction to Electrical Engineering, by H. H. Norris. Lectures, 2. II, 2. T. Th., 10 to 11.

(2) **Dynamo Drawing.**—Detail working drawing, tracing, and blue printing of electrical machines in the laboratory, to familiarize the student with the conventional methods of representing the different parts of dynamos and motors. Laboratory, 2. II, 2. F., 1 to 3:30; S., 8 to 10:30.

(3) **Dynamos and Motors.**—Principles of electro-magnetism, theory of dynamo electric machines, the design, construction and regulation of direct current dynamos and motors. Prerequisites: Physics (1) and calculus. Textbook: Elements of Electrical Engineering, by Franklin and Esty. Lectures, 3. I, 3. M. W. F., 10 to 11.

(4) **Electrical Laboratory.**—Laboratory tests to determine armature and field resistance, magnetic leakage coefficients, characteristic curves and the efficiency and regulation of various types of direct current machines. Prerequisites: Physics (2) and (6). Textbook: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. I, 2. M. T., 1 to 3:30.

(5) **Applied Electricity.**—Methods and calculations of wiring, theory of primary cells and storage batteries, electric light and electrical book:

Elements of Electrical Engineering, by Franklin & Esty. Lectures, 4. II, 4. M. T. W. Th., 10 to 11.

(6) **Electrical Laboratory.**—Tracing circuits and wiring, calibrating instruments, efficiency tests of storage batteries, and the candle power of incandescent lamps. Prerequisite: Physics (2). Textbook: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II, 2. M. T., 1 to 3:30.

(7) **Electrical Diagrams.**—Conventional methods of representing electrical wiring and appliances. Drawings and wiring diagrams of the switchboards in the laboratory and in the power house and diagrams of the wiring of the college buildings. Laboratory, 2. I, 2. T. Th., 10 to 12.

(8) **Dynamo Design.**—Problems in designing electro-magnets, dynamos and motors. Complete working drawings and specifications to accompany each design. Prerequisite: Dynamo drawing. Reference: Design of Dynamos, by S. P. Thompson. Laboratory, 3. II, 3. W. Th., 1 to 3:30; S., 8 to 10:30.

(9) **Alternating Currents.**—Theory of alternating currents, properties of alternating current circuits, principles of alternators, transformers, rotary converters and induction motors, methods of testing alternating current apparatus. Prerequisite: Physics (5). Textbook: Alternating Current Machines, by Sheldon, Mason & Hausmann. Lectures, 4. I, 4. M. T. W. Th., 10 to 11.

(10) **Electrical Laboratory.**—Laboratory tests of single phase alternating current generators, motors and transformers, calibration of alternating current measuring instruments and meters. Prerequisite: Physics (6). Textbook: Laboratory and Factory Tests in Electrical Engineering by Sever & Townsend. Laboratory, 3. I, 3. W. Th. F., 1 to 3:30.

(11) **Alternating Currents.**—Development of the symbolic method of Steinmetz, the solution of problems in transformer design and calculation of transmission line by the use of the algebra of complex numbers and by vector diagrams. Prerequisite: Alternating currents (9). Textbook: Alternating Current Phenomena, by Steinmetz. Lectures, 4. II, 4. M. W., 10 to 11. T. Th., 11 to 12.

(12) **Electrical Laboratory.**—Laboratory tests of polyphase alternating current apparatus, including generators, motors, transformers and converters. Efficiency and regulation tests of a mercury arc rectifier, connecting transformers for transforming from three phase to two phase. Prerequisite: Electrical Laboratory (10). Text book: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II, 2. Th. F., 1 to 3:30.

(13) **Electrical Design.**—Drawing and design of alternating current apparatus, circuits, and power plants. Open to students taking E. E. (9) and E. E. (11). Laboratory, 3. I, 3. M. T. Th., 8 to 10.



(14) **Contracts and Specifications.**—The law of contracts and its application to engineering contracts. Students are required to make specifications for estimates on proposed power plants, transmission lines or electrical apparatus. Textbook: *Business Features of Engineering Practice*, by A. C. Humphreys. Lectures, 1. II, 1. F., 10 to 11.

(15) **Wireless Telegraphy.**—Theory and development of wireless telegraphy; commercial apparatus and instruments for sending and receiving stations. Experimental tests. Prerequisite: Physics, (5). Text book: *Handbook of Wireless Telegraphy*, by J. Erskine Murray. Lectures, 2. Laboratory, 1. II, 3.

(16) **Electrical Design.**—Design and drawing of a transformer or induction motor to conform with certain specifications for efficiency, including the calculations of the weight and cost of the material. Prerequisite: E. E. (9). Laboratory, 3. II, 3. M. T. W., 8 to 10.

(17) **Seminar.**—Weekly meeting for the purpose of discussing current electrical engineering literature. Lectures, 1. I and II, 2. F., 9 to 10.

(18) **Special Design.**—Design and construction of some special electrical apparatus or machine. Elective for seniors. Laboratory, 3. I or I, 3.

(20) **Thesis.**—Before graduating each student must present a suitable thesis upon some engineering subject in line with his course. One copy of the thesis will be filed in the college library as the property of the college. The subject forthethesis must be chosen at the beginning of the senior year. 5. I and II, 5.

(21) **Elementary Drawing.**—Plain lettering, the use of instruments, geometrical problems, orthographic, isometric, and cabinet projections of simple objects. Laboratory, 3. I, 3. T. Th. S., 8 to 10.

## MECHANICAL ENGINEERING.

Professor Dearborn.

Mr. Challenger.

Mr. Miller.

Mr. Kately.

Mr. Park.

The facilities provided for the instruction and practice in the department of mechanical engineering include class rooms, drawing room and office occupying the south half of the basement of College Hall, wood shop, forge shop, iron and brass foundry, machine shop, office and reading room in the shop building, steam and material testing laboratory in the engineering laboratory, and the power plant of the college.

The drawing room is furnished with desks and drawers for one hundred and fifty-four students, and with numerous models, machine

parts, and blue prints of trade machinery. The equipment includes also demonstration apparatus, blue print facilities, beam compasses, protractors, odontograph and universal drafting machine. The work in drawing and design is carried on in such a way as to bring out its relation to the subsequent work in the shops, sound commercial practice being emphasized.

The material testing laboratory equipment includes a Riehle 100,000 pound testing machine, both automatic and autographic, with extensometer for tension and compression tests, and deflectometer for transverse tests; an Olsen torsion machine for specimens having a cross section up to one and one-four inches square; also micrometers, surface plate and gauge with micrometer indicator for testing parallelism, calipers, scales, etc.

The equipment available for steam and gas engine tests comprises, in part, the following: A 7x7 inch vertical steam engine with eccentric adjustable; an 8x12 in. automatic cut-off Woodbury engine, with water cooled brake wheel, connected up with a 50 H. P. Dean Bros. surface condenser and arranged to run condensing or non-condensing, and with or without live or exhaust steam in the cylinder jacket; an 11x12 in. automatic cut-off Lycoming engine direct-connected to a 40 K. W. direct current generator, furnishing light and power for the college; a 12 H. P. Reeves throttling governor gasoline engine; an 8x8 Ingersoll-Rand air compressor; all necessary brakes, generators and lamp banks for loading the engines; scales, meters, tanks, etc. In addition there are planimeters, separating and throttling calorimeters, thermometers, one Tabor (outside spring) indicator, one Thompson indicator, one set Crosby indicators, with electro-magnetic device for taking simultaneous cards, standard pressure gauges, apparatus for testing gauges and indicator springs under steam pressure and a Crosby oil pressure gauge testing outfit.

A one hundred twenty-five horse-power Root water tube boiler, a one hundred twenty-seven horse-power Stirling water-tube boiler, an Advance compound traction engine, together with pumps, ejectors, feed water heaters, fans, etc., and the station heating plant, furnish extensive facilities for the investigation of problems related to power production, heating and ventilation.

The shops are equipped with standard machinery, and tools for working wood and metal. This equipment is being added to as needed, largely by manufacture in the shops by the students, under the supervision of competent foremen.

The wood shop measures 36x50 feet and is furnished with modern wood-working machinery, including a 20 inch Fay planer, a 14 inch circular pattern saw, a 36 inch hand saw, a Fay universal jointer, a Fay and Egan friezer, a jig saw, foot mortiser, trimmer, a 16 inch pattern

lathe, seven 10 inch lathes with turning tools for thirty-six students, and seventy-two complete sets of carpenter tools, with benches for joinery, house carpentry, pattern work and cabinet work.

The forge shop is 28x60 feet and contains nineteen down draft power forges with Sturtvant blowers, a 50-lb. power hammer, shear, grinder, and a full equipment of anvils and small tools. In the work here a graded series of exercises leads the student from simple drawing and upsetting to size, to complex forging and tool making, hardening and tempering, all the work being done from working drawings.

The foundry, 30x48 feet, is equipped with a No. 1 Whiting cupola having a melting capacity of one ton of iron per hour, a brass furnace, core oven, crucibles, flasks and patterns. The work comprises bench and floor moulding, cupola and brass furnace practice, the product consisting of castings of machine parts, test bars, brass, bronze and other alloys for bearing metal, ornamental pieces, etc.

The machine shop measures 60x72 feet, and adjoining it are the tool room, stock room, office, lavatory and locker room. The equipment includes an 18-inch Davis and Egan, a 16-inch LeBlond and three 16-inch Flather engine lathes, a 14-inch Lodge and Shipley patent head tool room lathe, a 22-inch Flather planer, a 16-inch Davis and Egan shaper, a Gisholt tool grinder, a 28-inch Cincinnati drill, a 20-inch Prentice drill, a 14-inch sensitive drill, a 24-inch Barnes grinder, a 6-inch pipe machine, speed lathe, power hack saw, etc., and in the tool room a No. 1 Cincinnati universal milling machine, a Cincinnati universal grinder, a Yankee drill grinder, a brazing and tempering outfit, besides a complete equipment of small tools.

(1) **Mechanical Drawing.**—The use of drawing instruments and plain lettering; problems in geometric construction to teach accuracy in the use of instruments; orthographic projection; dimensions, arrangement, titles; tracing and blue-printing. Before beginning work, a student must provide himself with one of the following sets of drawing instruments or a set of equal quality: K. & E. No. 896 NCP with No. 523½ pen, or Dietzgen No. 937 C with No. 508 pen. Laboratory, 3. I, 3. F., 8 to 10; Tu. Th., 1 to 3:30.

(2) **Wood-work.**—A graded set of problems is given with instruction in the proper use and care of carpenter's tools and practice in working to dimensions from blue-prints, followed by a course in building construction, roof framing and mill work. Tools required: One B. & S. caliper rule. Laboratory, 2. II. T. Th., F., 1 to 3:30.

(2a) **Pattern Work.**—A graded series of exercises in wood turning, followed by lectures and practice in the construction of wood patterns for use in the foundry. Tools required: One 6-inch steel rule, 5-inch outside calipers. Laboratory, 2. I. Th. F., 1 to 3:30.

(3) **Descriptive Geometry.**—Projections of lines, plane surfaces and solids; intersections, tangents to curves and surfaces; problems in warped surfaces; practical applications. Text: Phillips & Millar. Lectures, 2; laboratories, 3. II, 5. T. F., 9 to 10; W., 10 to 11; Th., 8 to 10; F., 1 to 3:30.

(4) **Foundry.**—The instruction includes practice in floor and bench molding, core making, and in pouring castings of iron, brass and other alloys. Laboratory, 1. II, 1. M., 1 to 3:30.

(4a) Cupola and brass furnace practice in the manufacture of castings for machine parts, pipe fittings, test pieces, bearing metal, etc. Lectures or laboratory, 1. I, 1.

(5) **Mechanism.**—A study of the relative motions of machine parts, including rolling cylinders and cones, lobed wheels, belts, levers, cams, linkwork, parallel and straight line motions, as applied in engine indicators, indicator reducing motions and motor-car steering mechanisms. The design of cams and quick-returns for machine tools, with their velocity and acceleration diagrams. Text: Schwamb and Merrill, Elements of Mechanism. Lectures, 2; laboratory, 2. I, 4. M. W., 10 to 11; M. W., 1 to 3:30.

(6) **Forge Work.**—A graded set of exercises in iron forging, designed to teach the operations of drawing, upsetting, forming and welding, followed by exercises in forging, hardening and tempering tool steel. Tools required: One B. & S. caliper rule. Laboratory, 2. I. F., 1 to 3:30; Sat., 8 to 10:30.

(7) **Steam Engineering.**—A study of steam boilers, their classification and construction, their settings, furnaces and chimneys, and of the construction and use of the various accessories and appliances found in the boiler room; a careful study of combustion and furnace efficiency, and of the principles underlying the economical transfer of heat from the furnace to the water. Scale, corrosion and feed water treatment are given considerable attention. Text: Peabody and Miller, Steam Boilers. The course must be preceded or accompanied by (16). Prerequisites: Chemistry (1), and physics (1) and (2). Lectures, 3. I, 3. M. W. F., 11 to 12.

(8) **Mechanism.**—A continuation of (5) in the study of gearing; the cycloidal and involute systems, spur, bevel and screw gears, and the construction of the tooth; gearing in train, change gears for machine tools; epicyclic trains, with special application to automatic feeds, and differential transmission for tractors; intermittent motion, clicks, ratchets and escapements. Lectures, 2; laboratory, 2. II, 4.

(9) **Forge Work.**—A continuation of the work in steel forging, including tempering, annealing and case-hardening. Laboratory, 1. II, 1. F., 1 to 3:30.

(10) **Valve Gears.**—An analytic and graphic study of steam engine valve motions, and the use of the Zeuner, Bilgram and harmonic diagrams in the design of plain and double valves to fulfill given conditions. Reversing gear, Stephenson's link, radial gears; as applied to locomotives and tractors, and drop cut-off and non-releasing gears are analyzed and compared. Prerequisite: Mechanism (8). Laboratory, 2. I, 2.

(11) **Seminar.**—Weekly meetings for the presentation and discussion of papers upon assigned topics pertaining to mechanical engineering. Lecture, 1. I and II, 2.

(13) **Machine Design.**—A study of machines with regard to material, form and strength of parts, methods of construction. The development of rational and empirical formulae, the construction and interpretation of graphical charts involving engineering principles and data, and the graphical solution of problems involving stresses in cranes, structural members and machine parts. Complete working drawings, with notebook showing all calculations involved in the design of a power shear or press, hydraulic riveter or geared pump are required. Prerequisite: M. E. (10). Lectures, 3; laboratory, 3. II, 6.

(14) **Strength of Materials.**—The work consists of experimental determinations of the strength and various moduli of the more important of the materials of engineering. Tests are made in compression, tension, cross-bending and torsion, upon which written reports and discussions are required, involving a discriminating comparison of results with accepted experimental data. Taken with mechanics (6). Laboratory, 1. II, 1. F., 1 to 3:30.

(15a) **Mechanical Laboratory.**—The use and testing for error of micrometers, planimeters and slide rules. The calibration of pressure gages, indicator springs, scales and tachometers, and efficiency tests of jack screws and hoists. Reference: Carpenter and Diederichs' Experimental Engineering. Prerequisite: Physics (1). Laboratory, 1. II, 1. M., 1 to 3:30.

(16) **Power Plant Practice.**—Each student spends  $2\frac{1}{2}$  hours per week as assistant in the college power plant, obtaining practical experience under a first-class engineer in handling boilers, pumps, engines, heating apparatus and electrical machinery, including dynamos, motors, and switch board. Laboratory, 1. I, 1.

(17) **Machine Work.**—Instruction and practice in chipping, filing, laying out, fitting, scraping, soldering and brazing. Tools required: One 6-inch steel rule; 5-inch outside calipers. Laboratory, 2. I, 2. T. Th., 1 to 3:30.

(18) **Thermodynamics.**—A study of the principles and their technical application to gases, saturated and superheated vapors, and mixtures, comprising cycle processes, the flow of fluids through nozzles, and throttling processes, from the physical, analytical and graphical stand-



point. The work includes the solution of numerous practical problems involved in the design and operation of steam and gas engines, steam turbines, steam colorimeters, injectors, air compressors and refrigerating machinery. Text: Goodenough, Principles of Thermodynamics. Prerequisite: M. E. (7, 10, 16). Lectures, 5, II., 5., M. T. W. Th. F., 10 to 11

(20) **Steam and Gas Laboratory.**—Steam and gas engine indicator practice, valve setting by measurement and by the card, calorimetric determination of the quality of steam, tests of pumps, injectors, and engines. Prerequisites: Thermodynamics (18). Laboratory, 2. I.

(21) **Machine Work.**—Practice with instruction in drilling, boring, turning, thread and gear cutting. Prerequisite: (17). Tools required: Six-inch steel rule, 5-inch outside and inside calipers, center gage. Laboratory, 2. II, 2.

(22) **Steam and Gas Engineering.**—An extension of (18) in a study of the performance and design of steam and gas motors, air and refrigerating machinery from the thermodynamic standpoint. Text: Peabody, Thermodynamics; Ennis, Applied Thermodynamics; Heck, Steam Engine and Turbine. Lectures, 3. I, 3.

(23) **Engine Design.**—A course co-ordinating with (22) in the dynamics of machinery, with particular application in the design of the reciprocating parts of steam and gas engines, flywheels and governors. Balancing, stresses in turbine discs and critical velocity of shafts are discussed. Each student makes working drawings for the principal parts of a steam engine, a gas engine or a steam turbine. Text: Lanza, Dynamics of Machinery; Heck, Steam Engine and Turbine. Lectures, 2; laboratory, 2. I, 4.

(25) **Industrial Engineering.**—The organization and management of manufacturing establishments; cost accounting, distribution of expenses; systems of compensating labor; contracts and specifications. Lectures, 2. II, 2.

(27) **Machine Work.**—Advanced work on lathe, milling machine, and grinder. The manufacture of reamers, drills, taps, mills, and dies. The heat treatment of high speed steel. Laboratory, 2. I, 2.

(28) **Engineering Laboratory.**—A continuation of (20), including efficiency tests of heating, ventilating, compressed air, and power plant equipment. Laboratory, 2. II, 2.

(29) **Plant Design.**—The course comprises the design of a plant for a specific purpose—i. e., a heating, pumping, lighting, refrigerating, compressed air or shop plant. Lectures and recitations cover the location and construction of the buildings; heating, ventilating, lighting and fire protection systems; the working equipment and its arrangement; while working drawings are made showing the location of equipment, with calculations and specifications for certain details. Lectures, 2; laboratory, 3. II, 5.

(30) **Thesis.**—Before graduating, the student is required to present an acceptable thesis involving an investigation of some problem related to mechanical engineering, which will become the property of the college. The work will be done under the supervision of the head of the department, but the student will devise his own methods. The subject must be selected by November fifteenth of the senior year. II, 4.

## Division of Industrial Arts and Sciences

The college offers five separate courses leading to the degree of bachelor of science, which are tabulated on the following pages. It will be noted that in these tabulations there is but little change in the actual requirements from the work offered during the past years. In the earlier years of the course, much of the foundation work in science, language and mathematics is common to all the courses.

The names given to these courses are generally indicative of their nature—biology, chemistry, home economics, mathematics-physics and vocational English.

Candidates for the bachelor's degree in science must complete satisfactorily not less than 130 credits, including the prescribed work in military drill or physical training; and including also a thesis, the value of which in credits shall be determined by the instructor concerned. No regular student may take in any one semester work amounting to more than nineteen credits or less than twelve.

Students who are relieved for any reason of the requirements in military drill or physical training, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

Several subjects taught in departments not represented in this division are open to election by students in science on consent of their advisers. Among these may be mentioned music (limited to four credits for any one person) and such subjects in the divisions of agriculture or engineering as the applicant may be qualified for and as the schedule permits.

A more detailed statement of the direct purpose of each of these courses may be found just preceding the tabulation of each course.

## Biology

Through the electives allowed in the biology course, the student may select lines of work leading toward the following professions: General zoology; economic zoology; economic entomology; general botany; plant pathology and bacteriology.

The course also furnishes an excellent preliminary training for the professions of medicine, veterinary science, forestry and teaching.

In the government service, both in the Department of Agriculture at Washington and in the various experiment stations, there are many desirable openings both for young men and young women. In plant pathology, bacteriology, entomology and economic zoology, there is a growing demand for suitably qualified workers. Women are more and more in demand as scientific clerks and assistants.

The passage of the Adams Act, whereby the federal appropriation to the experiment stations in the various states is materially increased, is creating a greater demand for workers in biological as in other lines, and as never before the outlook in these lines is inviting.

Students in the biology course are allowed considerable latitude in choosing their electives, but it is intended that they shall be guided by their class officer in selecting the sub-courses that contribute most directly to their chosen line of work.

**BIOLOGY.****FRESHMAN YEAR.**

First Semester.		Second Semester.	
English Composition (Eng. 1)....	2	English Composition (Eng. 1)....	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
Trig. and Log. (Math. 2a).....	3	*Prin. of Plant Culture (Hort. 1) 3	
Gen. Chemistry (Chem. 1).....	4	General Chemistry (Chem. 1)....	4
Gen. Botany (Biol. 9).....	5	Plant Phys. (Biol. 10).....	4
*Mech. Draw. (M. E. 1).....	2	Drawing from Nature (Art. 4)....	2
Drill or Gymnasium .....	1	Drill or Gymnasium.....	1
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18		17	

**SOPHOMORE YEAR.**

Expository Composition (Eng. 2) 2	Expository Composition (Eng. 2) 2
Qualitative Analysis (Chem. 2).. 4	Organic Chemistry (Chem. 5)..... 5
Gen. Des. Physics (Phys. 1a)..... 3	Gen. Des. Physics (Phys. 1a)..... 3
Invertebrate Zool. (Biol. 1)..... 4	An. Phys. and Anat. (Biol. 3)..... 5
*Field Crops (Agron. 1)..... 5	Geology (Geol. 1)..... 3
Drill or Gymnasium..... 1	Drill or Gymnasium . . . . . 1
<hr/>	
19	19

**JUNIOR YEAR.**

Advanced Composition (Eng. 3)	Advanced Composition (Eng. 3)
or Literature (Eng. 10)..... 2	or Literature (Eng. 10)..... 2
Bacteriology (Biol. 12)..... 5	Plant Pathology (Biol. 11) or
General Entomology (Biol. 4)..... 4	Vertebrate Zoology (Biol. 2).... 4
Elective.....7 or 8	Organic Evolution (Biol. 14)..... 2
	*Farm Mechanics (Agron. 4)..... 3
	Elective.....7 or 8
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18 or 19	18 or 19

**SENIOR YEAR.**

Economics (Econ. 3)..... 2	Economics (Econ. 3)..... 2
Psychology (Phil. 1)..... 3	Ethics (Phil. 2)..... 3
Thesis .....	Thesis .....
Elective.....7 or 8	Elective.....7 or 8
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17 or 18	17 or 18

\*Women may elect other subjects.



## Chemistry

The principles of chemistry, together with some of the applications of the science, are taught to the freshmen in all courses offered by the college. In addition to this elementary instruction some departments require sufficient training in chemistry to enable the student to apply the principles of the science to some special phase of the general course he is pursuing. This is true in the college courses in agriculture, domestic science, pharmacy and sanitary engineering. Further, students who wish to follow chemistry as a profession are advised to take systematic training in the science during the four years of undergraduate study.

The outline of studies offered in the chemical course is designed to meet the needs of the last named class of students. The sub-courses listed in the freshman and sophomore years leave no room for electives and are required of all students registering in the chemistry course. These courses are all fundamental and are prerequisite to both the required and elective work offered in the last two years of the course.

Electives are offered in the junior and senior years in order that other subjects may be combined with chemistry with the idea of shaping the training toward some special field of the science. By a proper selection of electives it is possible to prepare for the following more or less distinct branches of the science: engineering chemistry, agricultural chemistry, biochemistry, and general chemistry. The electives will be assigned on consultation with the class officer as follows:

**Engineering Chemistry**—Electives may be taken from the sub-courses in civil, mechanical and electrical engineering, physics, mathematics, chemistry and language.

**Agricultural Chemistry**—Electives are to be selected from the sub-courses in biology, agriculture, chemistry and language.

**Biochemistry**—Electives must be selected from the sub-courses in biology mainly, together with language, physics and chemistry.

**General Chemistry**—Students who wish to specialize in pure chemistry may take electives in chemistry, physics, mathematics and language.

The engineering option offers a combination of studies which approaches what is usually known as a course in chemical engineering. It prepares for positions in chemical laboratories connected with manufacturing industries and for conducting operations requiring a working knowledge of both chemistry and engineering.

The agriculture, and biochemistry options give an excellent foundation for the study of almost any phase of agricultural science. They especially prepare for positions in experiment station laboratories and in government and state food laboratories.

**CHEMISTRY.****FRESHMAN YEAR.**

First Semester.		Second Semester.	
English Composition (Eng. 1)....	2	English Composition (Eng. 1)....	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
Algebra (Math. 1).....	3	Analytical Geometry and Calculus (Math. 3).....	4
Trigonometry (Math. 2).....	2	German or French.....	4
German or French.....	4	General Chemistry (Chem. 1).....	6
General Chemistry (Chem. 1).....	4	Drill .....	1
Mechanical Drawing (M. E. 1)....	2		
Drill .....	1		
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	19		18

**SOPHOMORE YEAR.**

Qualitative Analysis (Chem. 2) 5	Organic Chemistry (Chem. 5).....	5
Anal. Geom. and Calculus (Math. 4) .....	Anal. Geom. and Calculus (Math. 4) .....	5
General Physics (Phys. 1a).....	General Physics (Phys. 1a).....	4
German or French.....	German or French.....	4
Drill .....	Drill .....	1
	—	—
	19	19

**JUNIOR YEAR.**

Economics (Econ. 3).....	2	Economics (Econ. 3).....	2
Mineralogy (Chem. 12).....	3	Geology (Geol. 1).....	3
Advanced Inorganic Chem. (Chem. 6).....	3	Advanced Inorganic Chem. (Chem. 6).....	3
Quantitative Analysis (Chem. 3) 4	Quantitative Analysis (Chem. 3) 4		
Elective .....	5 to 7	Elective .....	5 to 7
	—		—
	17 or 19		17 or 19

**SENIOR YEAR.**

Organic Analysis (Chem. 4).....	4	Industrial Chemistry (Chem. 9) 4	
Thesis (Chem. 16).....	2	Thesis (Chem. 16).....	2
Elective.....	10 to 12	Elective.....	10 to 12
	—		—
	16 or 18		16 or 18

## Home Economics

The object of this course is two-fold: First, to give young women a liberal education with a scientific basis, and to train them along lines pertaining to the science, management and care of the home. Second, to give training to those who wish to become teachers of home economics. This course gives an opportunity for the combination of biology, chemistry, physics and art with home economics.

In the junior and senior years there is considerable opportunity for electives, but electives must be chosen by the advice and with the approval of the class officer. A choice is given in the junior year between history and science and art, music and English may be elected. History, chemistry, biology, and music and English may be elected in the senior year.

**HOME ECONOMICS.****FRESHMAN YEAR.**

First Semester.		Second Semester.	
English Comp. (Eng. 1).....	2	English Comp. (Eng. 1).....	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
German or French.....	4	German or French.....	4
Trig. and Log. (Math. 2a).....	3	Prin. of Cookery (H. E. 1).....	4
General Chemistry (Chem. 1).....	4	General Chemistry (Chem. 1).....	4
Sewing (H. E. 11).....	3	Art (Art 1) .....	2
Physical Training.....	1	Physical Training.....	1
<hr/>		<hr/>	
18		18	

**SOPHOMORE YEAR.**

Expository Comp. (Eng. 2).....	2	Expository Comp. (Eng. 2).....	2
German or French .....	4	German or French .....	4
Org. and Food Chem. (Chem. 8) ..	4	Org. and Food Chem. (Chem. 8)..	3
Invertebrate Zoology (Biol. 1)....	4	Food Studies (H. E. 2).....	4
Dressmaking (H. E. 12).....	2	Animal Physiology (Biol. 3).....	5
Household Architecture (H. E. 3) ..	2	Physical Training .....	1
Physical Training.....	1	<hr/>	
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19		19	

**JUNIOR YEAR.**

Economics (Econ. 3).....	2	Economics (Econ. 3).....	2
Bacteriology (Biol. 12).....	5	Invalid Cookery (H. E. 3).....	2
Textiles (H. E. 13).....	2	Dressmaking (H. E. 14).....	3
Advanced Cookery (H. E. 4).....	2	Costume Design (Art. 8).....	2
Dietetics (H. E. 6).....	2	Household Management (H. E.	
Hist. or Household Phys.		7) .....	4
(Phys. 9).....	3	Hist. or Animal Nutrition	
Electives .....	0 to 3	(Chem. 11).....	3
<hr/>		Elective.....	0 to 3
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19		19	

**SENIOR YEAR.**

Home Problems (H. E. 9).....	2	Sociology (Economics 4).....	3
Psychology (Phil. 1).....	2	Teaching of Domestic Science	
Seminar (H. E. 10).....	2	(H. E. 8).....	3
Teaching of Domestic Art		Embroidery (H. E. 16).....	2
(H. E. 15).....	2	Thesis .....	2 to 4
Thesis .....	2 to 4	Elective .....	3 to 7
Elective .....	2 to 8	<hr/>	
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19		19	

## Mathematics and Physics

This course as outlined on the opposite page is designed to fill the needs of two or three classes of students. The required work is such as to give an excellent preparation for students desiring to become teachers in these subjects, and by proper choice of the electives a broad education in other subjects may be obtained. Prospective teachers are advised to arrange their electives so that they will be qualified to teach other subjects, such as biology, chemistry, English or foreign language, as often they are required to teach such subjects in combination with mathematics or physics.

There is an increasing demand for men who have a more extended and exact knowledge of the fundamental sciences than can be obtained from the ordinary technical course. This comes from a class of employers who desire men so equipped and prefer to give them the practical training they need. This course is designed to give the theoretical training. If the student should take this course, planning to take an engineering course later, he can choose his electives so that any of the engineering courses may be completed in two years after graduation from the mathematics-physics course. In this case the following subjects are suggested from which it is desirable to elect: Freehand drawing, mechanical drawing, chemistry, mechanics, applied electricity, dynamos and motors, hydraulics, sanitary engineering. The particular electives of this course will be chosen in accordance with the direct aim of the student. In addition, the above course lays a foundation for the work of the graduate school.



**MATHEMATICS—PHYSICS.****FRESHMAN YEAR.**

First Semester.		Second Semester.	
English Composition (Eng. 1).....	2	English Composition (Eng. 1).....	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
Algebra (Math. 1).....	3	Anal. Geometry and Calculus	
Trigonometry (Math. 2).....	2	(Math. 3).....	4
German or French.....	4	German or French.....	4
General Chemistry (Chem. 1).....	4	General Chemistry (Chem. 1).....	4
Military Drill or Physical Train-		Military Drill or Physical Train-	
ing .....	1	ing .....	1
	—		—
	17		16

**SOPHOMORE YEAR.**

Expository Composition (Eng. 2)		Expository Composition (Eng. 2)	
or English Literature (Eng.		or English Literature (Eng.	
10) .....	2	10) .....	2
Analytical Geometry and Calcu-		Analytical Geometry and Calcu-	
lus (Math. 4).....	5	lus (Math. 4).....	5
General Physics (Phys. 1).....	3	General Physics (Phys. 1).....	3
Physical Measurements (Phys.		Physical Measurements (Phys. 2) 2	
2) .....	2	German or French.....	3 or 4
German or French.....	3 or 4	Elective .....	0 to 4
Elective .....	0 to 4	Drill or Physical Training.....	1
Drill or Physical Training.....	1		
	—		—
	16-19		16-19

**JUNIOR YEAR.**

Differential Equations (Math.		Geology (Geol. 1).....	3
10) .....	3	Differential Equations (Math.	
Electricity and Magnetism		10) .....	3
(Phys. 5).....	4	Light and Sound (Phys. 3).....	2
or Least Squares (Math. 5).....	2	Physical Measurements (Phys. 4).....	2
Economics (Phil. 3).....	2	Economics (Phil. 3).....	2
Elective.....	6 to 10	Elective.....	6 to 8
	—		—
	15-19		15-19

**SENIOR YEAR.**

Theoretical Astronomy (Math. 6) 3		Theoretical Astronomy (Math. 6) 3	
Physics (Phys. 6).....	3	Physics (Phys. 6).....	3
Mathematics (11, 12, 13 or 14)....	3	Mathematics (11, 12, 13 or 14)....	3
Elective and Thesis.....	7 to 11	Elective and Thesis.....	7 to 11
	—		—
	15-19		15-19

## Vocational English

Among the subjects for the teaching of which funds are appropriated out of the federal treasury to all the land grant colleges, is English. The state law under which the Montana State college is organized, specifies instruction and education in the English language, and literature, as the first purpose of the college. In line with this authority and the general purpose of the institution, a course is offered which, using the work in the English language and literature, especially in English composition, as the foundation, has been planned with "special reference to their application to the industries of life."

This course is not planned to lead to any one occupation, to the exclusion of all others, and may be used as giving a fair general English education to those who have not yet chosen a vocation. It prepares definitely for various kinds of office work, in business and the professions, including the work heretofore offered as the secretarial course. It is a good preliminary education for newspaper work, in almost any of its business or editorial lines. It would be a good preliminary course for those planning to take up the law, especially for such as must earn their way. It affords a good education for a business man, who wishes a wider range than the secondary school can offer him.

In the arrangement of the work on the opposite page, it will be noted that a good deal of space is left for electives. It is not to be understood that these electives are to be chosen at random; they must be chosen under the limitations prescribed; and also in consultation with the class officer who will aid in working out a scheme of electives which will shape each student's course so as to lead to some definite kind of proficiency which will be remunerative. An effort will be made to arrange such a plan for each student upon his entering the course, subject to such modifications as seem best to him and his advisers.

The work required from each student includes, besides the English already named, one course in laboratory science, two years, at least, of some language other than English; three years of history, two years of economics, and less amounts of two or three other subjects.

One laboratory science must be chosen either in the freshman or sophomore year. Among the subjects which may be elected in the freshman year are shorthand, typewriting, cooking, sewing, art; chemistry, biology; mathematics; French, German, Spanish. Among the subjects which may be elected in the Sophomore year are shorthand, typewriting, business correspondence, principles of accounting, office practice; physics, mathematics, biology, chemistry, geology; cooking, sewing, art; French, German, Spanish, English.

### VOCATIONAL ENGLISH. FRESHMAN YEAR.

First Semester.		Second Semester.	
English Composition (Eng. 1).....	2	English Composition (Eng. 1).....	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
English History (Hist. 1).....	3	English History (Hist. 1).....	3
French, German or Spanish.....	4	French, German or Spanish.....	4
Drill or Gymnasium.....	1	Drill or Gymnasium.....	1
Elective.....	6 to 8	Elective .....	6 to 8
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17 to 19		17 to 19	

### SOPHOMORE YEAR.

Expository Composition (Eng. 2) 2	Expository Composition (Eng. 2) 2
English Literature (Eng. 10)..... 2	English Literature (Eng. 10)..... 2
French, German or Spanish..... 4	French, German or Spanish..... 4
Drill or Gymnasium..... 1	Drill or Gymnasium..... 1
Elective.....8 to 10	Elective.....8 to 10
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17 to 19	17 to 19

### JUNIOR YEAR.

English (Eng. 11, 13 or 5)....2 or 3	English (Eng. 11, 13 or 5)....2 or 3
History (Hist. 2 or 5)..... 3	History (Hist. 2 or 5)..... 3
Economics (Econ. 3)..... 2	Economics (Econ. 3)..... 2
Commercial Law (Com. 8)..... 3	Commercial Law (Com. 8)..... 3
Elective.....5 to 9	Elective.....5 to 9
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16 to 19	16 to 19

### SENIOR YEAR.

Psychology (Psych. 1)..... 3	Sociology (Econ. 4)..... 3
Industrial History (Hist. 10)..... 3	Industrial History (Hist. 10)..... 3
Advanced Economics (Econ. 5).... 3	Advanced Economics (Econ. 5).... 3
Elective.....7 to 10	Elective.....7 to 10
<hr/>	
16 to 19	16 to 19

Electives in the junior and senior years are to be chosen in accordance with the plan worked out in the freshman and sophomore years under the advice of the class officer. Many of the subjects open for the sophomore year, if not chosen then, may be elected during the last two years. Other subjects for election during the last two years are business methods, principles of banking, newspaper writing, English.

**ART.**

Miss Lana A. Baldwin.

Miss Genevieve Lane.

The art department occupies the entire north front of the second floor in College Hall. The studios are large and well lighted.

The department has a very complete and carefully selected collection of casts from the antique, including full length casts of the Venus de Milo, Borghese Warrior, and the Winged Victory.

The equipment for work in the handicrafts includes work benches and full sets of tools for each individual student electing work in metalry and jewelry, potter's wheels for throwing and casting pottery and a china kiln of the largest size for firing china.

There is a fine collection of works on art in the library suitable for class reading and serious study, also photographs from foreign countries and reproductions of celebrated pictures.

1—**Drawing** from the cast in charcoal, pencil, crayon or pen and ink. Also still life and object drawing. I and II, 4, 6. T. Th., 9 to 11.

2—**Painting** in water color and oil.

(a)—Work from nature and still life. Prerequisite: Art (1). I and II, 6.

(b)—**Illuminating** on vellum or parchment. Prerequisite: Art (1) and art (7). I and II, 2-4.

3—**Architectural Drafting**.—Study of architectural shades and shadows, also conventional rendering in wash and color. Freehand perspective sketching from mechanical drawings. Sketching from nature when weather permits, in pencil and water color. I, 3.

4—**Drawing from Nature**.—In pencil, pen and ink, wash and color. This is intended especially for students in biology. II, 2. T. Th., 10 to 12.

5—**Clay Modeling**.—Decorative work from original designs, given in connection with study of historic ornament and design. I or II, 2.

6—**History of Art**.—This work is intended especially for students in design. Particular attention is given to the study of historic ornament and the classic styles as exemplified in painting, sculpture and architecture. I and II, 4.

7—**Design**.—Study of applied design and incidentally the use of water colors. Students submit original designs. I and II, 4.

8—**Costume Design**.—The study of color and design as applied to dress. History of costume. This course is made as practical and helpful as possible. Students prepare original designs which are executed in the sewing classes. II, 2.

8a—**Embroidery Design**.—Students study theory of color and design and submit original designs for embroidery. Work rendered in black and white and in color. II, 2.

8b—**Household Decoration**.—Study of color, line and form as applied

to house furnishings. Students are given practical problems to demonstrate these theories. I and II, 2-4.

9—**China Design.**—Study of applied design for the decoration of china. This includes study of color. I and II, 4.

10—**Painting on China**—Students to be admitted to the classes in china painting must satisfy the instructor that they have the necessary preparation to undertake the work profitably. China is fired in the studio. Prerequisite: (1), (2), (9). I and II, 4-8.

11—**Leather.**—Tooling, modeling and embossing; also use of dyes and stains for leather. Prerequisite: (7). I and II, 4.

12—**Jewelry.**—Making of simple and unique jewelry in silver and in copper. This includes saw-piercing, enameling, repousse and the setting of semi-precious stones. Prerequisite: Course (7). I and II, 4-6.

13—**Metal.**—Work in copper, brass and silver. This course includes raising, saw-piercing, etching, hard and soft soldering and riveting. Prerequisites: Art (7). I or II, 4-6.

### BIOLOGY.

Professor Cooley.

Professor Swingle.

Assistant Professor Spaulding.

Mr. Jennison.

The biology department now occupies the whole of the building formerly used also by the Experiment Station and the agricultural departments. The building has been remodeled and made more suitable for biological work.

In the basement is a lecture room with seating capacity for fifty students, equipped with a lantern and a large stock of lantern slides and wall charts, illustrating various courses in biology. On the east side of the basement is the herbarium room containing a large and valuable collection of Montana plants and many from other parts of the world. The south side of the same floor is divided into a station laboratory and a large storeroom.

The entire west half of the first floor serves as a laboratory for the larger classes, and is equipped with the necessary furniture and compound and dissecting microscopes. The east half of the first floor is occupied by the office of the department, the department library and a private laboratory for the station entomologists. This laboratory contains a large representative collection of Montana and exotic insects, which is being constantly added to.

The second floor is given over to laboratories and the office and laboratory of the station botanist. The west laboratory is used by the smaller classes in zoology and physiology and contains dissections of the various animals studied, as well as a portion of the general zoological collection.



The east laboratories are fitted for bacteriological work with special student lockers, incubators, steam and dry air sterilizers and culture rooms.

The third floor is occupied by a zoological lecture room, with wall cases containing different animals and dissections for illustrating lectures; a small museum room and a private laboratory.

Two greenhouses on the south side of the building are used for class and station work in plant physiology and pathology. These are equipped with the necessary plants and apparatus for experimental plant physiology. Opening out of the main greenhouse laboratory are an insectary for the rearing of insects and a dark room for photographic work and for conducting experiments in plant physiology.

The department library contains a valuable set of the most important books and periodicals upon biological subjects. Large collections of specimens and mounts in the various branches of biology are being constantly added to, making important adjuncts to the class and laboratory work in these subjects.

(1) **Invertebrate Zoology.**—Devoted to the study of the invertebrate animals, including their morphology, development, habits, economic or popular interest, and classification. The broad biological principles are brought out and emphasized. The class room work is based on Hegner's "Introduction to Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of animals. Required of agricultural, home economics and biology students. Lectures, 2; laboratory, 2. I, 4. Assistant Professor Spaulding. M. W., 8 to 9; W. F., 1 to 3.

(2) **Vertebrate Zoology.**—A continuation of (1), taking up vertebrate (chordate) forms. Required of animal industry and biology students. Prerequisite: Biol. (1). Lectures, 1; laboratory, 3. II, 4. Assistant Professor Spaulding. Hours to be arranged.

(3) **Animal Physiology and Anatomy.**—By means of lectures and demonstrations the main principles of animal physiology are presented to the students, while in the laboratory they become familiar with the most important features of mammalian anatomy. Required of agricultural, home economics, pharmacy, and biology students. Prerequisite: Biol. (1). Lectures, 3; laboratory, 2. II, 5. Assistant Professor Spaulding. Th., 8 to 9; M. W., 9 to 10; W. F., 1 to 3.

(4) **General Entomology.**—Lectures on the morphology, metamorphoses and classification of insects and a study of the various orders. Collecting, naming, labeling and arranging in museum form species that are to be found in the vicinity of Bozeman. Required of biology and agricultural students. Elective for others who have taken (1). Lectures, 2; laboratory, 2. I, 4. Professor Cooley. M. W., 9 to 10; T. Th., 1 to 3.

(5) **Advanced Entomology.**—This course is a continuation of the general entomology course (4), and is made up of lecture, reading and

conference work and of laboratory exercises. Students in this course will be assigned laboratory work best suited to their special requirements. Lectures, 2; laboratory, 2. II, 4. Professor Cooley. M. W., 9 to 10; T. Th., 1 to 3.

(6) **Economic Entomology.**—Principles underlying insect depredations and their control; insecticides and insecticide machinery; notable insect pests of our time and of earlier times; entomological journals and early literature; prominent workers of today and earlier times. Lectures, 3; laboratory, 1. II, 4. Professor Cooley. Hours to be arranged.

(9) **General Botany.**—Morphology, anatomy and elementary physiology of plants, including life history studies of all the groups. The fundamental biological principles are here laid down on which all higher botanical studies are based. Required of all biology and agriculture students. Lectures, 2; laboratory, 3. I, 5. Professor Swingle and Mr. Jennison. T. Th., 9 to 10; M. T. Th., 1 to 3.

(10) **Plant Physiology and Histology.**—Experimental work in the movement, growth, nutrition and reproduction of plants with a microscopical study of the structures involved. Prerequisite: Biology (9) and first semester of chemistry (1). Required of agricultural and biology students. Lectures, 1; laboratory, 3. II, 4. Professor Swingle and Mr. Jennison. M., 1 to 3; T., 9 to 11; Th., 8 to 10; F., 10 to 11.

(11) **Plant Pathology.**—General facts and principles governing the health and disease of plants, with illustrative experiments, followed by a study of the classification, morphology, and special physiology of parasitic plants, with especial reference to diseases of cultivated crops in Montana. Prerequisite: Biology (9) and (12). Required of agronomy and horticultural students. Lectures, 1; laboratory, 3. II, 4. Mr. Jennison. T., 10 to 11; T. W. Th., 1 to 3.

(12) **Bacteriology.**—A study of the structure, life history and classification of bacteria, their growth in nutrient media, and methods of bacteriological technique. The relation of bacteria to agriculture, disease, and our daily life is discussed. Prerequisite: Biology (9) or (3) and chemistry (1). Required of agricultural and home economics students. Lectures, 2; laboratory, 3. I, 5. Professor Swingle and Mr. Jennison. T. Th., 10 to 11; F., 1 to 3; T. Th., 8 to 10.

(13) **Embryology.**—An introductory course in embryology, embracing a study of the foundation and growth of tissues in the vertebrate body, based chiefly on a study of the chick, but including consideration of the development in the mammalia. Open to students who have completed biology (2) or (3). Lecture, 1; laboratory, 3. I, 4. Assistant Professor Spaulding. Hours to be arranged.

(14) **Organic Evolution.**—A lecture course treating of the different evolution theories and their present status; will also include such topics as the origin of species, heredity, variation, natural and artificial selection, adaptations, etc. Lectures and assigned reading. Required of agri-

culture and biology students and elective to students who have completed at least two courses in biology. Lectures, 2. II, 2. Assistant Professor Spaulding. T. Th., 11 to 12.

(15) **Thesis.**—Students in the biology course in their senior year and seniors from other courses, who have had sufficient previous training in biology, may devote a maximum of five credits per semester to thesis work, under the direction of Professors Cooley or Swingle, or Assistant Professor Spaulding.

## CHEMISTRY.

PROFESSOR COBLEIGH.

ASSISTANT PROFESSOR BARNES.

The applications of chemistry to the various phases of agriculture, to engineering and to many modern industries, make this science an important one in a technical school. The fundamental courses of the science should be thoroughly taught in order that the student may have sufficient training and independence to apply his knowledge to practical operations. If the student is to master the principles of chemistry and at the same time obtain a working and practical knowledge of chemical manipulation, he must have certain facilities at his disposal.

Below is given somewhat in detail, a description of the equipment and the conveniences provided for the study of chemistry in this institution:

The lecture room, with raised floor and seating capacity for one hundred and fifty students, has a lecture desk provided with water, gas, and electricity, a demonstration balance and stereopticon for showing the applications of the science. The class room exercises in general and applied chemistry are illustrated by experiments, lantern slides, and in many cases by exhibits of the raw materials and finished products of commercial processes. The lecture room equipment is in an adjoining room, which also serves as a private laboratory.

There are five laboratories equipped for the following lines of work: General chemistry, qualitative and quantitative analysis, organic and food chemistry, physical chemistry, and assaying. All desks are provided with water, gas, electricity, and filter pumps where needed. The hoods in each laboratory are furnished with gas and water and connections from a large Parson's hydrogen sulphide generator, which will supply forty jets at one time. In each hood there are large steam and air baths in operation at all times, being connected to the steam heating plant. The building is well ventilated by means of a mechanical draft, and heated by a direct-indirect steam system. With some of the classes working in sections the laboratories will accommodate 150 students.

The store room is stocked with an ample supply of the apparatus and chemicals needed for the various laboratory courses. The student secures what equipment he needs from time to time, in addition to that always

kept in his desk, from the storekeeper, who is on duty at convenient and stated hours. The equipment includes, besides the usual stock of apparatus, much that is designed for special use, such as accurate balances for both quantitative analysis and assaying, standard weights, equipment for calibrating measuring apparatus, polariscopes, Abbe refractometer, oil testers, apparatus for water, air, and gas analysis, combustion furnaces, Hoskin's crucible and muffle furnaces for experiments necessitating high temperatures, apparatus for gas density determinations, Beckman's freezing and boiling point apparatus, and equipment for conductivity measurements, etc.

The department museum occupies a well lighted room in the basement. In this room are stored in cabinets, and glass exhibit cases, the collections illustrating chemical industries of various kinds, and the mineralogical and geological specimens. The mineral collection is quite extensive. It includes a valuable private collection purchased by the college some years ago. To this was added a part of the Montana mineral exhibit at Chicago in 1893, and large additions have been made from time to time through exchanges and purchases. The collection is thoroughly representative and forms an important adjunct to the chemical department.

The chemical library and office is located on the first floor and contains full sets of the American Journal of Science, Journal of the American Chemical Society, Journal of the (London) Chemical Society, Berzelius Jahresbericht, Bericht der deutschen Chemischen Gesellschaft, and Fresenius Zeitschrift für Analytische Chemie. There are also partial sets of Chemical News, and the Analyst. Besides these the library contains many standard reference works and the recent text books. There are also index volumes and card catalogues to facilitate more ready reference to the literature.

(1) **General Chemistry.**—Two lectures, one recitation and one 2½-hour laboratory period per week throughout the year on the fundamental laws of chemistry, the history, occurrence, preparation and properties of the common elements and their compounds. Text books: General Chemistry, by Kahlenberg, and laboratory notes prepared by instructors in the department. Lectures, 2; quizzes, 1; laboratory, 1. I and II, 8. Lectures, M. W., 9 to 10. Quizzes, 3 sections, Th., 8 to 9; M. W., 11 to 12. Laboratory, 3 sections, M. W. F. 1 to 3:30.

(2) **Qualitative Analysis.**—Lectures and recitations two hours per week on the theory and practice of qualitative analysis. Laboratory practice two afternoons per week in the analysis of simple salts, complex mixtures, ores and minerals. Prerequisite: Chemistry (1). Text book: Qualitative Analysis, by Baskerville and Curtman. I, 4. M. W., 10 to 11. T. Th., 1 to 3:30.

(3) **Quantitative Analysis.**—Two lectures and recitations per week on the theory and technique of the laboratory methods and chemical calculations. Five hours of laboratory work per week. The analyses



required in the course include the following: Magnesium sulphate, potassium alum, iron ammonium alum, iron ore, limestone, clay or slag, zinc, lead copper manganese, arsenic, antimony, and nickel ores alkalimetry, acidimetry and flue gas. Prerequisite: Chemistry (1) and (2). Text books: Miller's Notes on Quantitative Analysis for Mining Engineers; Treadwell's Quantitative Analysis; and Miller's Calculations of Analytical Chemistry. I and II, 8. Hours to be arranged.

(4) **Organic Analysis.**—Lectures and recitations on the methods used for the analysis of organic substances and agricultural products. The laboratory portion of the course includes analysis of the following: Feeding stuffs and cereals, fertilizers, soil, sugar, milk, butter, oils, alcohol glycerol, formaldehyde and the detection of adulterations in food. Prerequisites: Chemistry (3) and (5). Text book: Proximate Organic Analysis, by Sherman. I and II, 8. Hours to be arranged. Not offered in 1913-14.

(5) **Organic Chemistry.**—An elementary course designed to make the student familiar with the principles of organic chemistry and with the more important compounds of both the aliphatic and aromatic series. Remsen's Organic Chemistry is used in the class room and the laboratory work is based on Orndorff's Laboratory Manual, and Gaettermann's Practical Methods of Organic Chemistry. Prerequisites: Chemistry (1) and (2), I or II, 5. T. Th. F., 9 to 10. T. Th., 1 to 3:30.

(6) **Advanced Inorganic Chemistry.**—Lectures and recitations on general theoretical chemistry in which special attention is given to the study of the elements according to the periodic classification of Mendeleef. Prerequisites: Chemistry (1), (2) and (5). I and II, 6. Hours to be arranged.

(7) **Agricultural Chemistry.**—This course is designed especially to meet the needs of the students in the four-year course in agriculture. Lectures and recitations on the chemistry of soil, manures and fertilizers, plants, and animal products. The laboratory work includes the following analyses: Magnesium sulphate, potassium alum, iron and ammonium alum, soil, cereal or feeding material, milk or butter. Text books: Ingle's Manual of Agricultural Chemistry; Lincoln and Walton's Quantitative Analysis for Agricultural Students. Prerequisites: Chemistry (2) and (5). I, 4, and II, 2 or 4. W. F., 10 to 11; W., 1 to 3:30; F., 8 to 10.

(8) **Organic and Food Chemistry.**—This course is especially designed for students in the sophomore year of the home economics course. The first twelve weeks are devoted to the study of pure organic chemistry, both in the class room and in the laboratory. The next twelve weeks are devoted to the study of qualitative analysis. Substances of household interest and importance are analyzed and their uses discussed. These two divisions of the course give the fundamental knowledge necessary for the last twelve weeks of the course, which are devoted to the study of the composition of foods, their manufacture, preservation and adulteration.



Prerequisite: Chemistry (1). Text books: Outlines of Organic Chemistry by Moore; Qualitative Analysis by Baskerville and Curtman, and Sanitary and Applied Chemistry, by Bailey. I, 4 or 5, and II, 3 or 4.

(9) **Industrial Chemistry.**—Lectures and recitations on the applications of chemistry to industrial problems. In general the course includes fuels, refractory materials, limes, mortars, and cements, timber and its preservation, iron and steel, water, illuminating gas, explosives, and lubricating oils. The lectures are supplemented by laboratory exercises in quantitative analysis. Prerequisite: Chemistry (1), (2) and (3, I or II, 5. Hours to be arranged. Not offered in 1913-14.

(10) **Sanitary Chemistry.**—The sanitary analysis of water and air with discussions of the interpretations of analytical results. Prerequisite: The first semester of Chemistry (3), and Chemistry (5). II, not offered in 1913-14.

(11) **Animal Nutrition.**—Lectures on the functions of fats, carbohydrates, protein, and salts in nutrition, together with a study of the chemistry of digestion and metabolism. Prerequisite: Chemistry (5) or (8), and biology (3). Text book: Chemistry of Food and Nutrition, by Sherman. II, 3. M. W. F., 10 to 11.

(12) **Mineralogy.**—Blowpipe analysis, elementary crystallography and determinative mineralogy. Lectures and laboratory work. Text book: Moses and Parson's Mineralogy. I, 3 or 4. Hours to be arranged.

(15) **Seminar: Abstracting.**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors where the topics are freely discussed. Students are thus kept in touch with the progress of the science. I and II, 2.

(16) **Thesis.**—Students in the chemistry course are required in the senior year to prepare a graduate thesis on some subject which will involve considerable laboratory work and as much originality as possible. I and II, 4.

#### ENGLISH.

Professor Brewer.

Mrs. Herrick.

Mr. Gilruth.

The library has abundant equipment for all the work offered in English. There are complete standard texts of practically all the authors referred to in any of the courses. Besides these there is a fair supply of biographical, critical and historical works, sufficient for ordinary reference use. The library equipment is complete enough so that thus far students have been able to do the reading assigned without the necessity of purchasing many books.

Though many classic novels are to be found on the shelves, no effort

has been made in the college library to provide current fiction.

In all the courses in English, written work plays an important part. That this work may be kept up to the proper grade, it is announced here that in college English work no paper will receive any credit that shows notable carelessness or ignorance in elementary matters of punctuation, grammar, rhetoric, or in the spelling of common words.

(1) **English Composition.**—The course is required of all freshmen. The course is almost altogether practice in various types of prose composition; narration, description, exposition, criticism, and argumentation. The class meets ordinarily twice a week. The instructor from time to time meets each student for private conference about his work. Lectures. I and II, 4. Mr. Gilruth. Two divisions. M. W., 10 to 11. T. Th., 11 to 12.

(2) **Expository Composition.**—This is a course primarily in expository writing and intended for students who will go into scientific or technical work. Papers prepared in scientific or technical courses, if not too technical, may be handed in as part of the work of this course. The year's work may also include some practice in business correspondence and in argumentative writing in preparation for English (5). I and II, 4. Prof. Brewer. T. Th., 8 to 9. T. Th., 10 to 11.

(3) **Advanced Composition.**—This is an advanced course for those who wish to study composition as a fine art. It will include a study of the historical development of English prose style and such other work as may suit the taste or needs of those who elect the course. Lectures. I and II, 4. Prof. Brewer. Hours to be arranged.

(4) **Public Speaking.**—Informal lectures; drill in articulation and intonation. Declamation exercises with criticism by instructor and students. Extemporaneous speaking and training in the writing of the different forms of public discourse. The course will close with a study of the essential principles of debating; each student will be required to take part in at least one debate. Required of all freshmen. I and II, 2. Mr. Gilruth. Two divisions. F., 9 to 10. W., 11 to 12.

(5) **Argumentation and Debating.**—Study of the principles of argumentation and master pieces of forensic oratory. Preparation of briefs and forensics. Conferences, lectures, debates and other forms of public address. Elective for seniors and juniors who have credit for courses (1), (2) and (4). I and II, 4. Mr. Gilruth.

(6) **Interpretive Reading.**—This course will include work in the cultivation of the voice and the study of gesture, together with a large amount of drill in interpretive reading from standard literature, both prose and poetry, and especially in oratory and the drama. It is intended for those who expect to take part in oratorical or declamatory contests, and in college plays. It is elective for sophomores, juniors, and seniors. Prerequisite: English (1) and English (4). With the consent of the instructor, it may be taken in the first half-year separately. I and II, 4. Mrs. Herrick.

(7) **Newspaper Writing.**—This is a course for those who are interested in newspaper writing, and will include practice in its various forms along with the study of good newspapers. Some one of the numerous manuals on the subject of newspaper work will be used as a guide. So far as the facilities at the disposal of the English department allow, the work will be made practical. Lectures on newspaper work will be given by newspaper men of standing at intervals in this course. Those who intend to elect this course should seek positions on the college paper early in their course.

(10) **English Literature.**—A reading course in English literature including about twenty of the more important authors. A large amount of reading is required and more recommended. Written reports on the reading are frequently required. A part of the class room time is given to critical reading of English masterpieces. Lectures, recitations, and conferences. I and II, 4. Prof. Brewer. M. W., 9 to 10.

(11) **English Essayists of the Nineteenth Century.**—A study of the more important essayists from Charles Lamb to R. L. Stevenson. Lectures and recitations. I and II, 4. Prof. Brewer. Hours to be arranged.

(12) **Shakespeare.**—A careful reading of three plays in the class room, and outside reading in other plays of the period. Lectures and recitations. II, 4. Prof. Brewer. Hours to be arranged.

(13) **Victorian Poetry.**—A study of the poetry of the Victorian period, with special reference to the work of Alfred Tennyson, Robert Browning, and Matthew Arnold. Lectures and recitations. I and II, 4. Prof. Brewer. Hours to be arranged.

Course 10 is given every year and is prerequisite to courses 11-13. Courses 11-13 are not all given in the same year. Classes will be organized when a sufficient number of students elect any course.

## FRENCH AND SPANISH.

Miss Wallin.

(1) **French.**—First year's work includes elements of grammar based on Fraser and Squairs' French Grammar, with constant practice in pronunciation, dictation, and conversation. Reading of easy texts. I and II 8. M. T. W. F., 8 to 9.

(2) **French.**—Review of grammar. Typical fiction and dramas of the nineteenth century are studied. Advanced composition and original theme writing. Conversation and dictation. I and II, 8.

(3) **French.**—Study of classic French literature of the seventeenth and eighteenth centuries, such as Corneille, Racine, Moliere, LeSage and Voltaire. Collateral reading and reports. Lyric poetry. I and II, 6.

(20) **Spanish.**—Hill and Ford's Grammar, reading, composition. Much attention is given to pronunciation. Reading of such texts as Valera's *El Pajaro Verde*, Alarcon's *El Sombrero do Tres Picos*, and Moratin's *El si de las Ninas*. I and II, 8. M. T. W. Th., 11 to 12.

**GEOLOGY.****Mr. Barnes.**

The aim of the course in geology is to give the student a comprehensive view of the science as a whole. While geological processes and their results are given considerable attention, other phases of the subject are not entirely neglected. Thus, the course also includes a brief discussion of the principal types of rocks and rock minerals; as well as a number of the more important applications of economic geology, especially in connection with the origin of some of our more important ore bodies. The work closes with a consideration of some of the later theories in regard to the earth's formation, and a brief review of the earlier stages of the planet's history. As far as time permits the applications of the science to agricultural and engineering problems are especially emphasized.

The college museum, containing an excellent collection of minerals, rocks, and fossils, is constantly drawn upon for illustrative material. In addition, the publications of the United States Geological Survey are at the command of the student, and are used as references in connection with special topics. A set of lantern slides is used for illustrating many of the lectures. Besides the class room work a number of field trips are taken by the class, where the action of geological forces in the past are pointed out and studied. The college is located in an excellent region for this field study, and many interesting phases of the subject are presented close at hand. The field work is concluded with a one-day trip to Morrison Cave, a very interesting formation lying about thirty miles west of Bozeman.

(1) **Geology.**—Lectures, recitations, and assigned reading in dynamical and structural geology. Text: Chamberlain and Salisbury's College Geology. Prerequisite: Chemistry (1). II, 3. M. W. F., 10 to 11.

**GERMAN.****Miss Cehrs.**

(10) **German.**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes pronunciation, grammar, selections in prose and verse, with practice in speaking and writing German. I and II, 8. M. T. W. F., 8 to 9.

(11) **German.**—A continuation of the above course. The work consists of reading of texts suitable for second year work; for the most part, the writings of contemporary authors. Memorizing of easy colloquial sentences and poems. Conversation and composition. An effort is made to familiarize the student with the customs, life and spirit of the German people. I and II, 8. M. T. W. Th., 11 to 12.

(12) **German.**—This course, open to freshmen, is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics

will be studied; also scientific texts if desired. Conversation and composition. I and II, 8. M. T. W. F., 8 to 9.

(13) **German.**—An elective course offered to those who have completed course (11) and (12). It consists chiefly of advanced reading of a practical, scientific or literary character, as the needs of the students electing it may dictate. I and II, 8.

### HISTORY.

Assistant Professor Brewer.

The department has a set of MacCoun's historical charts of the United States and two sets of historical geography charts of Europe by the same author; Johnston's series of maps of ancient geography; ten of Breitschneider's maps of medieval Europe; and a set of maps of the modern world.

The library contains the laboratory of the historical department, but a catalogue of the histories would be too voluminous to include here. In Greek and Roman history, besides the standard narrative works, there are translations of the best source material for this period. For English history the library is well equipped with general works and has source material including Colby, Lee and the University of Pennsylvania collection, Evelyn's Diary, a file of "The Gentleman's Magazine," etc.

Naturally the works on the United States history are the most numerous. The standard general histories, as well as works on limited periods or regions, and the best biographies of American statesmen, are in the library. The reports of the American Historical Association, and the Congressional Records, come to the library. There are also many contemporary records, among which are the Old South Leaflets, Hart's American History Told by Contemporaries; the complete works of Jefferson, Hamilton and other statesmen, and the Jesuit Relations.

The college has a reflectoscope installed in the class room, which is at all times available for showing pictures of historic scenes and objects. A large number of views belonging to the teacher are used in all classes.

(1) **English History.**—It is taken for granted that the student has had a preparatory course in general history, with some such text as Myers or West. In this course constant study of the text book is supplemented by lectures on the English constitution and on the development of continental Europe. Special topics with library references are occasionally assigned. I and II, 6. M. W. F., 10 to 11.

(2) **Medieval History.**—The student is supposed to have had courses which have given him knowledge of the great epochs in history and their relations to each other. Therefore, in this course he will take up the thorough history of one period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available in translations. In this connection the student will be given practice in the application of the fundamental rules used in testing the value of historical material. I and II, 6. M. W. F., 8 to 9. (The Renaissance in Italy, given in 1913-14).



(5) **American History.**—This is a course in United States history covering the period of constitutional development and with special reference to that development. The use of the library rather than of any text book is required in this course, and the student is expected to spend about one-fourth of the time in the preparation of a paper on some selected subject. Course 2 should precede this course. I and II, 6. (Given in 1912-13). M. W. F., 8 to 9.

(6) **Thesis.**—For research work in his senior year the student is allowed to select any historical subject which he is qualified to investigate; and for which some material is available either in translation or original.

(10) **Industrial History.**—The development of the complex industrial life of today. Besides the industries of the United States, the course may include industries commercially important to the United States in the European states. A general knowledge of English history will be presumed. The text-book in the hands of students will be supplemented by special topics.

### HOME ECONOMICS.

Professor Harkins.

Assistant Professor Ballinger.

Miss Hess.

The third floor of the new agricultural building is occupied by the home economics department. At the north are two kitchen laboratories, on either side of the hall. One, 34x26 feet, has two coal ranges, seventeen electric stoves and desks for twenty students. The other, 27x26 feet, has one coal range and fourteen desks, fitted with individual gas stoves. All tables are well supplied with cooking utensils. Adjoining the east kitchen is a dining room, and beyond it the department office. There are also store rooms, pantries and cold storage rooms.

In the south end of the building is a large sewing room, 47x31 feet, with a class room, 31x16 feet, two small fitting rooms, and cases for the work of 104 students. Connected with these are two small sewing rooms, and a bedroom. The department has nine sewing machines of various makes, electric irons, cases for exhibition work, looms for rug weaving, and large and small work tables.

(1) **Principles of Cookery.**—This work includes both lecture and oratory work on the composition and preparation of foods. Lectures on marketing and care of food materials; also visits to the various markets. The object of the course is to teach plaincooking based upon scientific principles. Text: Norton's Food and Dietetics. Lecture, 1; laboratory, 3. II, 4. T. Th., 9 to 11. W., 1 to 3:30.

(2) **Food Studies.**—This course is designed to make practical application of the science underlying the selection and preparation of foods. The dishes prepared illustrate the scientific principles involved. Prerequisites: Home economics (1); chemistry (1) and (5). Lecture, 1;

laboratory, 3. II, 4. Th., 9 to 10. M. T. Th., 1 to 3:30.

(3) **Home Architecture, Decoration and Sanitation.**—Evolution of the home, modern houses; site, surroundings, construction, heating, lighting, plumbing and drainage. Practice in drawing floor plans of houses. Lectures on the history of furniture, floor coverings and wall hangings, economic problems in house furnishings. I, 2.

(4) **Advanced Cooking.**—In this course menus are planned and meals prepared. The student has instruction in the making of a few difficult and fancy dishes. Prerequisites: Home economics (1) and (2). Laboratory, 2. I, 2. M. W., 8 to 10.

(5) **Home Nursing and Invalid Cookery.**—The work in home nursing includes lectures and demonstrations by local physicians and trained nurses. Invalid cookery includes a consideration of the diet under abnormal conditions; the preparation of invalid dishes; and the dietetic treatment of certain diseases. Prerequisites: Home economics (4); Chem. (5); Biol. (12). Lecture, 1. Laboratory, 1. 11, 2. M. W., 8 to 10.

(6) **Dietetics.**—This course treats of the fundamental principles of human nutrition and metabolism, the relation of food to health, and the construction and preparation of dietaries. Prerequisites: Home economics (2); chemistry (5); biology (12). Lecture, 1; laboratory, 1. I, 2. Th., 11 to 12. M., 1 to 3:30.

(7) **Household Management.**—Organization of the household; expenditure of income; education for the home; household accounting; care of the house and other essentials of a well ordered home. Prerequisite: H. E. (3). II, 4.

(8) **Teachers' Course.**—In this course both the theory and practice of teaching domestic science is given. A study is made of the courses of study in various institutions. Courses of study are planned for graded schools, high schools, and colleges. Each student has work in practice teaching. Prerequisites: Home Economics (1), (2), (3), (4), (5), (6) and (7). Lecture, 2; laboratory, 1. II, 3.

(9) **Seminar.**—A study of the various phases of home economics. In this course the student gives at least three lectures on some home economics problem; it is then discussed by the class. I, 2.

(10) **Home Problems and Demonstrations.**—Individual problems in food work. Food demonstrations. Laboratory, 2. I, 2, 4.

(11) **Elementary Clothing.**—The fundamental principles of hand and machine sewing applied to the making of aprons and undergarments. Taking measurements, drafting, use of patterns and computation of cost. The drafting system and apron materials are included in the fee. Other materials provided by the student, subject to approval of instructor. Finished garments are the property of the student. I, 3. T. Th. F., 1 to 3:30.

(12) **Dressmaking.**—A course in sewing applied to the making of shirtwaists and simple cotton dresses. Designing and drafting patterns. Computation of costs. I, 2. M. W., 9 to 11.

(13) **Textiles.**—This course comprises a study of fabrics, beginning with their place in primitive life and tracing their development, manufacture, and economic value up to the present time. Prerequisites: Chemistry (1); home economics (11) and (12). I, 2.

(14) **Advanced Dressmaking.**—This course includes the making of a woolen dress or suit and a dress for afternoon or evening wear. II, 3. M. W. F., 1 to 3:30.

(15) **The Teaching of Domestic Art.**—Fine hand sewing and its application to garments chosen as problems in a sewing course; lesson plans, courses of study and equipment. Prerequisites: Home Economics (11), (12), (13) and (14). I, 2.

(16) **Embroidery.**—This course deals with the principal stitches used in decorative art. The decoration of household linens, undergarments and dresses is given attention. II, 2. T. Th., 1 to 3:30.

(17) **Thesis.**—Students in the home economics courses are required to prepare a thesis on some subject pertaining to home economics; or with the consent of the class officer they may take the same number of credits in a science subject pertaining to home economics.

(18) **Special Credits.**—Students who have practiced teaching in the Bozeman public schools or in the college will be allowed credits (not to exceed 2) for this work.

## MATHEMATICS.

Professor Tallman.

Miss Bull.

The students in this department have access to the following journals: American Journal of Mathematics (complete set); Annals of Mathematics (from 1900); Bulletin of American Mathematical Society (1898 to date); also about 200 volumes of recent treatises on mathematics. It may also be mentioned that our library is especially well equipped with treatises and journals of applied mathematics found in the libraries of the engineering and physics departments.

(1) **Algebra.**—Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and groups, binomial theorem, theory of limits, undetermined co-efficients, logarithms and an introduction to the theory of equations. I, 3. M. W. F., 8 to 10, and M. W. F., 10 to 11.

(2) **Plane Trigonometry.**—For engineering and science students. I, 2. T. Th., 10 to 11.

(2a) **Plane Trigonometry and Logarithms.**—For agricultural and home economics students. I, 3. M. T. Th., 11 to 12; and M. T. Th., 8 to 9.

(3) **Analytical Geometry and Calculus.**—This course includes the geometry of the straight line and conic section coupled with the elements of differential calculus. II, 4. M. T. W. Th., 8 to 9. M. T. Th. F., 10 to 11.

(4) **Analytical Geometry and Calculus (continued).**—This course which deals largely with the differential and integral calculus also takes up some problems in analytical geometry not treated in course (3), especially the geometry of three dimensions and also includes an introduction to differential equations. I and II, 10. M. T. W. Th. F., 9 to 10.

(5) **Method of Least Squares.**—I, 2. T. Th., 8 to 9.

(6) **Theoretical Astronomy.**—Integration of equations of motion, computation of orbits and ephemerides. This course should be preceded by course (5) in physics and must be preceded by course (4) in mathematics. I and II, 6.

(7) **Applied Algebra.**—This course is designed for students who do not expect to go further into the study of mathematics. Starting with a review of some of the fundamentals of elementary algebra the course deals with such subjects as ratio and proportion, mathematical inductions, probable results and errors from experimental data, etc., as will assist the students in their scientific work. For agricultural and home economics students. II, 2. M. W., 8 to 9.

(10) **Differential Equations.**—Ordinary and partial differential equations with geometrical and mechanical applications. I and II, 6. M. W. F., 8 to 9.

(11) **Partial Differential Equations of Mathematics-Physics.**—This course will be based on Weber's "Die Partiellen Differential Gleichungen der Mathematischen Physic," and Byerly's "Spherical Harmonics." A great many applications to concrete problems will be made throughout the course. I and II, 6.

(12) **Newtonian Potential.**—Lectures on the theory of potential, with an introduction to spherical harmonics. I and II, 4.

(13) **Algebra (Advanced).**—This course will be an extension of course (1), and will contain discussion of complex numbers, theory of algebraic functions, etc. Care will be taken to show the practical application of each subject as the work advances; that is, such subjects as the connection between complex numbers and alternating currents, etc., will be fully explained. I and II, 6.

(14) **Analytical Geometry (Advanced).**—This course is a continuation of course (4). As the time given in course (4) for geometry of three dimensions is very limited it will receive considerable attention in this course. I and II, 6.

(15) **Thesis.**—Students specializing in mathematics are required to present a thesis on some chosen subject. This subject must be chosen and approved not later than November 15 of the senior year. A great deal of work in this line is desired, as it is believed there is no better way of developing a habit of independent thought.

Only a selection of courses (10) to (14) will be given each year, those being chosen for which most students apply. The special object of our work here is to make the course in applied mathematics complete,

and the work in pure mathematics will have as its object the laying of a good foundation for the more advanced work in applied mathematics. Those desiring to do work which is not offered in the above courses may consult the professor in charge of the department.

### PSYCHOLOGY AND ECONOMICS.

President Hamilton.

(1) **Psychology.**—This course presents a general view of modern psychology and is required of all general science students. It gives a practical exposition of the materials and methods of psychological investigation. The lectures are accompanied by class demonstrations. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training, the higher intellectual faculties, and the will. So far as possible the work is made practical and concrete. I, 3. M. T. Th., 9 to 10.

(3) **Economics.**—This course consists of a study of such subjects as land, capital, labor, money, coinage, banking, rent, interest, wages, and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, cooperation, recent currency legislation, and the single tax. I and II, 4. M. W., 11 to 12.

(4) **Sociology.**—The origin and history of human society, the various social theories and the laws of human intercourse are treated. Attention is given to such practical subjects as the government of cities, settlement work, the enrichment of country life, and charity work. Lectures and recitations. Elective. II, 3.

(5) **Advanced Economics.**—A study of the organizations, relations and problems of labor and capital; monetary systems and methods of banking; systems of taxation and sources of revenue; public expenditures. I and II, 6.

### PHYSICS.

Professor Ham.

Mr. Haines.

The following courses in physics are designed to meet the needs of (1) those students who are preparing to take up some of the more technical studies in engineering or agriculture, (2) those who expect to become physics or science teachers, and (3) those general science students who wish to acquire some of that kind of scientific training which is peculiar to the science of physics alone.

The facilities at the disposal of the physics department are described below somewhat in detail.

The lecture room is located in the basement of the chemistry and physics building. The lecture desk is supplied with gas and both alternating and direct current circuits. A projection lantern is permanently set up and is used constantly to illustrate the class room exercises. A



large collection of lantern slides has been prepared, which cover the whole subject of physics. The apparatus for lecture demonstration has been carefully selected and is sufficiently complete for giving experimental illustrations of all the principles of the science that are usually included in college courses.

For laboratory instruction three well lighted and conveniently furnished rooms are provided on the second floor of the building.

One of these rooms is equipped for electrical measurements and is wired with both alternating and direct current circuits, conveniently arranged for experimental purposes. The galvanometers are permanently located in convenient positions. The following forms are available: Tangent astatic, Thompson, differential, Northrup, and eight forms of the D'Arsonval type, including two with ballistic suspensions. In addition to the above equipment the following instruments are used in the various experiments taught, viz: magnetometer, standard resistance and condenser, an air condenser for determining the ratio of the electrostatic to the electromagnetic units, Carhart-Clark cells, wire and box forms of the Wheatstone bridge, Carey Foster bridge, Callendar and Griffith's bridge, rheometer, electro-dynamometer, ammeters, voltmeters, Leed's potentiometer, platinum thermometer, thermocouples, earth inductor standard solenoid, Thompson integrating wattmeter, and a permeameter with ten different specimens of iron for experiments in magnetization and hysteresis.

The second laboratory is furnished and equipped for teaching mechanics and heat. The equipment includes the following: micrometer and vernier gauges, spherometer, cathetometer, balances and weights, hydrometers, Atwood's machine, Young's modulus apparatus, torsion apparatus, torsion pendulums, apparatus for resolution and composition of forces, impact, harmonic motion, principle of moments, centrifugal force, and surface tension; simple and Kater's pendulums, a laboratory clock, thermometers, air thermometer, calorimeters, expansion apparatus, hygrometers, Searle's mechanical equivalent of heat apparatus.

The third laboratory is used for the study of light and sound and also for the elementary classes in the preparatory school. The equipment for teaching light and sound includes the following: a photometer, spectrometer, spectroscope, mirrors, prisms, lenses, diffraction gratings, optical bench, Fresnel mirror and bi-prism, apparatus for polarized light, microscope, telescope and an Abbe refractometer, sonometers, Kundt's tubes, siren, Lissajous apparatus, and Helmholtz resonators.

For the study of radioactivity and allied phenomena, there is a large induction coil, a variety of Crookes' and X-ray tubes, Wilson electro-scope, radium compounds and other radio-active material.

The physics library is located in one of the laboratories for students' use. It contains many of the best books and general works on physics,

and the current numbers of the Philosophical Magazine, the Physical Review, Science Abstracts, Section A, Bulletins of the Bureau of Standards, and School Science and Mathematics.

(1a) **General Descriptive Physics.**—Two lectures and laboratory work two and one-half or five hours per week in mechanics, heat, light and electricity. Special attention is given in this course to the study of such physical principles as those involved in the capillary action of soils, the osmotic action of plants, the movements of winds and moisture, the causes of the deposition of dew and the prevention of frost. Physics (1a) is prescribed in the courses in agriculture and biology. Prerequisites: Mathematics (2) or (2a), and physics (a) or its equivalent. Text books: General Physics, by Crew; Laboratory Course, by Sabine; Laboratory Physics, by Miller. I and II, 6 or 8. M. W., 11 to 12; M., 1 to 3:30.

(1) **General Physics.**—Lectures, recitations, and assigned problems, three hours per week throughout the year on mechanics, heat, magnetism, and electricity. This course is more mathematical and technical than physics (1a) and is particularly designed to meet the needs of students in engineering and the science students in the mathematics-physics course. Students who have not completed the calculus, mathematics (4), are required to take it during the same year that physics (1) is taken. Text book: General Physics, by Hastings and Beach. I and II, 6. M. W. F., 10 to 11.

(2) **Physical Measurements.**—A laboratory course designed to supplement physics (1). It is strictly quantitative and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to offer a training in making measurements of precision. Text books: Mechanics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. I and II, 4. T. Th., 1 to 3:30.

(3) **Light and Sound.**—Lectures and recitations two hours per week on wave motion, the theory of light in its application to familiar optical phenomena and to optical instruments, and on the phenomena and laws of sound. Prerequisites: Physics (1) and (2). Text book: Light and Sound, by Franklin & McNntt. II, 2. T. Th., 8 to 9.

(4) **Physical Measurements.**—A laboratory course in light and sound to supplement physics (3). II, 2. T. Th., 1 to 3:30.

(5) **Electricity and Magnetism.**—Two lectures and two laboratory periods per week on methods for the exact measurements of resistance, electromotive force, current, capacity, and the co-efficient of self-induction. The calibration of commercial instruments, insulation testing, and magnetic measurements, such as finding the permeability and the hysteresis effects of different samples of iron, will also be included in this course. Prerequisites: Physics (1) and (2) and differential and integral calculus. I, 4. T. Th., 8 to 9; W. F., 1 to 3:30.

(6) **Advanced Physics.**—Physics (6) is primarily a laboratory

course and is offered as an elective to science and engineering students. Conferences and assigned reading are essential features of the course. A more complete study of the precision of measurements will be made than was attempted in physics (2).

There are four separate parts to this course from which the work desired may be selected.

(a) **Heat.**—A study of exact methods of thermometry, pyrometry, calorimetry and determination of the mechanical equivalent of heat. Prerequisites: Physics (1), (2) and (5). I or II, 3.

(b) **Light and Radioactivity.**—Conferences, assigned reading and a series of standard laboratory experiments to illustrate diffraction, interference and polarization of light, spectroscopy, photometry, conduction of electricity through gases, and the phenomena of radioactivity. Prerequisites: Physics (3) and (4). I or II, 3.

(c) **Electricity and Magnetism.**—This course is offered as an elective in the science and electrical engineering courses to those who wish to continue the subject beyond the requirements of physics (5). I or II, 3.

(d) **Pedagogy of Physics.**—This course will be modified from year to year to suit the needs of the individual student. In general the course will include discussions of the methods of teaching, the selection and performance of effective lecture table and laboratory experiments and practice in presenting the topics covering such experiments to elementary and college classes. Prerequisites: Physics (1), (2), (3) and (4). I or II, 3.

(7) **Thesis.**—Students in the mathematics-physics group who elect physics as their major subject are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible.

(9) **Household Physics.**—This course is offered to students in the home economics course and to women in the other college courses who desire a better knowledge of the physics that is used in many of the household operations. Special attention will be given in this course to the physics of ventilation, the lighting and heating of houses, the principles of electric, gas, and water meters, etc. Two lectures and one laboratory. I, 3.

### COMMERCIAL SUBJECTS.

Prof. Brewer.

Mr. Gilruth.

Miss Jones.

(1) **Shorthand.**—A thorough knowledge of the fundamental principles of shorthand practice in word building, phrasing and dictation. I and II, 8. M. T. W. Th., 9 to 10.

(2) **Shorthand.**—Practice for the purpose of acquiring speed. Actual correspondence, reports of addresses, legal papers and miscellaneous matters to acquire a large shorthand vocabulary. I and II, 6.

(3) **Typewriting.**—Instruction in the use and care of typewriters. Exercise for the development of proper wrist and finger movements and for the mastery of the keyboard. Practice in letter writing and the use of carbon. I and II, 8. T. W. Th. F., 1 to 3:30.

(4) **Typewriting.**—Practice in transcribing from shorthand notes and from manuscript. Dictation for the attainment of speed and accuracy; also practice in the use of the mimeograph. I and II, 6.

(5) **Business Correspondence.**—A practice course in all forms of business correspondence. Attention is paid to spelling, punctuation, paragraphing and the correct arrangement of materials, both as to form and language. II, 3. M. T. Th., 11 to 12.

(6) **Office Practice.**—Practice with the various kinds of office appliances and equipment, such as adding machines, duplicators, filing cases and card systems. Preparing copy for press and proof reading, typography and illustration. I and II, 4.

(7) **Business Methods.**—A practical course in business methods, including the principles of business organization and administration. How to do business with the postoffice, banks, railroads, express, etc. I, 3.

(8) **Commercial Law.**—A course in the principles of elementary business law. Students will be required to familiarize themselves with rights and liabilities growing out of the more common business relations. Principles governing the drawing and the validity of commercial paper will be emphasized. Text and occasional lectures by practicing attorneys. II, 3.

(9) **Principles of Accounting.**—The course deals with principles governing accounting. The aim of the course is to enable the student to understand the principles underlying all accounting rather than to confine him to a set system, but at the same time to enable him to quickly grasp the details of any system. I and II, 6.

(10) **Principles of Banking.**—The course aims to study the various forms of transactions with banks. A more extensive study of commercial paper will be made and an attempt will be made to witness from time to time the handling of business through a bank. I, 3.

#### SCHOOL OF ART.

Miss Baldwin.

Miss Lane.

That the study of drawing is important in education is now universally acknowledged. Aside from the advantages to engineers, machinists, and architects of practical knowledge of draughtsmanship, the

psychologic value of a knowledge of drawing is very great. The chief object of education is in the quickening of the powers of the mind. Drawing brings out the power of analysis, habits of observation, qualities of judgment, imagination, memory and taste. It is something more than mere training of the eye. To achieve even moderate success requires that thought be put into every line. A line put down without thought is always a wrong line.

Art, aside from anything we can produce, helps us to appreciate the work of great artists and opens our eyes to the beauty of form and color in nature. It extends our powers of enjoyment and gives us a better understanding of the history of the human spirit. It gives a proper gratitude for the work of the great artists.

With the coming of the applied arts movement, has come the demand for work in manual training directly related to, and based upon art principles. With the purpose in view courses are offered in artistic handicraft, jewelry, hammered metal, pottery and leather work with all the facilities and equipment needed for artistic and practical work.

Students who are admitted in the art courses are admitted without further tuition fees to such other work of the college as their preparation will permit them to pursue to advantage. Attention is called in this connection to the work offered in history, literature, languages, home economics, music (which is charged separately) and in engineering and mechanic arts. The art course, as here outlined, will indicate the work of the average student in a four year's course planned for those who attend mainly for art work. The student is carried forward just as rapidly and as his own talent and industry will permit.

The course offers thorough training in the study of form, color, ornament, historic art, principles of design and composition and in technical methods in applied design. It insures a broad foundation of art culture and skill which will enable students to make practical use of their training. The theory of design is presented as fundamental to the crafts. Exceptional facilities are offered for the study of design and composition and the course is strengthened by the many phases of related art work carried on in the school. Every effort is made to teach drawing. The pupil is then encouraged to follow any line of art work for which he seems best fitted. For example, a pupil may elect to specialize in handicraft. Having completed the required work in drawing and design he may study any handicraft for which he has developed some ability or shown especial talent.

Attention is called to the regulation printed on page 20 regarding work done suitable for exhibition purposes.

Art schools unrelated to colleges have often lacked the finer influences of literature, the broadening environment, the healthy stimulus of systematic work and the wider circle of social life. It is thus a



decided advantage for the art school to have the association with the religious, social and literary life of the college.

For admission to the course in art, the requirement is the same as for the regular degree course, fifteen units of preparatory or high school work. For a detailed statement of the requirements see page 15.

**ART COURSE.****FIRST YEAR.**

First Semester.		Second Semester.	
Eng. Comp. (Eng. 1).....	2	Eng. Comp. (Eng. 1).....	2
German or French.....	4	German or French.....	4
Drawing (1).....	6	Drawing .....	7
Perspective and Comp.....	1	Design .....	4
Design .....	4	Public Speaking (4).....	1
Public Speaking (4).....	1	Phye. Training.....	1
Phys. Training.....	1		
	—		—
	19		19

**SECOND YEAR.**

English (10).....	2	English (10).....	2
German or French.....	4	German or French.....	4
Drawing .....	4	Drawing .....	4
Painting .....	2	Painting .....	2
History of Art.....	2	History of Art.....	2
Design and Handicraft.....	4	Design and Handicraft.....	4
Phys. Training.....	1	Phys. Training.....	1
	—		—
	19		19

**THIRD YEAR.**

History (1).....	3	History (1).....	3
Drawing and Painting.....	6	Drawing and Painting.....	6
Advanced Design and Handicraft	6	Advanced Design and Handicraft	6
Elective .....	4	Elective .....	4
	—		—
	19		19

**FOURTH YEAR.**

Drawing and Painting.....	6	Drawing and Painting.....	6
Advanced Design and Handicraft	6	Advanced Design and Handicraft	6
Elective .....	7	Elective .....	7
	—		—
	19		19

For a description of the art work outlined above see pages 76  
77 of this catalogue.

# School of Pharmacy

Professor Mollett.

This school offers two and three-year courses which afford a thorough training in all branches of pharmacy and pharmaceutical chemistry. These courses lead to the degree of Pharmaceutical Chemist (Ph. C.), and qualify the graduate who has had the required experience to meet the examination given in any state for the position of registered pharmacist.

The two-year course requires two full academic years for completion and provides the foundation in biology, chemistry and pharmacology as applied in the various pursuits of the profession of pharmacy.

The three-year course includes the same subjects in chemistry and pharmacy and affords the student an opportunity of extending his pharmacy education with advantage, over a period of three years. This course is especially recommended to applicants who are not high school graduates, or otherwise well qualified to pursue the two-year course.

Candidates for admission must be at least eighteen years of age, unless they are graduates of accredited high schools, or of schools maintaining courses of equal length and rank, and may be admitted: (a) by presenting a certificate of graduation from an accredited high school, (b) by presenting a certificate from an accredited high school, signed by the principal or superintendent, showing that not less than two years of work have been completed; (c) by an examination on an equivalent amount of work in subjects designated by the college; (d) by faculty approval of grades from other than accredited high schools.

While it is not compulsory, it is advised that students have one or two years practical training in a drug store before entering, and in certain cases drug store experience may count towards the second year of the two years of high school work required for entrance.

Applicants who furnish the regular college entrance requirements, fifteen units, and complete sixty-five credits of approved work in the college in addition to those outlined in the two-year course may receive the degree, Bachelor of Science (B. S.) in Pharmacy.

In addition to the annual tuition fee of \$12.00, deposits are required as indicated on page. 14.

The students have access to such of the chemical and botanical laboratories as the work calls for, as well as those of pharmacy and materia medica. Those laboratories contain all the modern equipment necessary for the proper instruction of the students. Free access is also granted to the standard reference books, in the several branches of science, and the magazines and journals of biology, chemistry and pharmacy.

Lectures will be given throughout the course on chosen subjects, by those who have gained prominence in pharmaceutical pursuits, and

in the sciences closely related to pharmacy. All pharmacy students will be required to attend these lectures.

All regular students will be required to keep notes on the work done, and present the same for examination and rating. Oral and written quizzes will be given during each course, and a final written examination at the close of the senior year covering the entire course of instruction in pharmacy. This examination will resemble those given by the state boards of pharmacy.

This school is recognized by the State Board of Pharmacy, and graduates, upon payment of the regular fee, may receive their certificates of registration without examination, as follows: Those furnishing satisfactory evidence to the Board of having had two years of practical experience in a drug store, may become Assistant Registered Pharmacists, and those having had four years practical experience, may become Registered Pharmacists.

### PHARMACY.

#### Three Year Course.

##### FIRST YEAR.

First Semester.		Second Semester.	
English (1 or b, c or d).....	2 or 4	English (1 or b, c or d).....	2 or 4
Introductory Pharmacy (Phar. 1)	4	Official Galenical Pharmacy	
Pharmaceutical Problems		(Phar. 3).....	4
(Phar. 2).....	2	Manufact. Pharmacy (Phar. 4)....	2
General Chemistry (Chem. 1).....	4	General Chemistry (Chem. 1).....	4
Elective .....	3 or 1	Elective.....	3 or 1
—		—	
	15		15

##### SECOND YEAR.

Qualitative Analysis (Chem. 2)...	4	Quantitative Analysis (Chem. 3)	4
General Botany (Biol. 9).....	5	Plant Phys. and Hist. (Biol. 10)	1
Pharmacy Latin (Phar. 12).....	3	Physiology (Biol. 3).....	5
Elective .....	3	Pharmacognosy (Phar. 5).....	3
—		Elective .....	2
	15	—	
			15

##### THIRD YEAR.

Organic Chemistry (Chem. 5).....	5	Animal Nutrition (Chem. 11).....	2
Bacteriology (Biol. 12).....	2	Microscopical Study of Powdered	
Pharmacopoeial Salts (Phar. 6)	5	Drugs (Phar. 7).....	2
Drug Analysis (Phar. 8).....	3	Materia Medica, Therapeutics	
		and Toxicology (Phar. 9).....	4
		Prescription Reading and Dis-	
		pensing (Phar. 10).....	3
		Urinalysis (Phar. 11).....	2
		Elective .....	2
—		—	
	15		15

## Two Year Course.

## FIRST YEAR.

General Chemistry (Chem. 1).....	4	General Chemistry (Chem. 1).....	4
General Botany (Biol. 9).....	5	Plant Phys. and Hist. (Biol. 10)	1
Introductory Pharmacy (Phar. 1)	4	Physiology (Biol. 3).....	3
Pharmaceutical Problems		Official Galenical Phar. (Phar. 3)	4
(Phar. 2).....	2	Manufacturing Pharmacy	
Pharmacy Latin (Phar. 12).....	3	(Phar. 4).....	2
—		Pharmacognosy (Phar. 5).....	3
18		—	
		17	

## SECOND YEAR.

Organic Chemistry (Chem. 5).....	5	Quantitative Analysis (Chem. 3)..	4
Qualitative Analysis (Chem. 2)..	4	Animal Nutrition (Chem. 2).....	2
Bacteriology (Biol. 12).....	2	Microscopical Study of Powdered	
Pharmacopoeial Salts (Phar. 6)..	5	Drugs (Phar. 7).....	2
Drug Analysis (Phar. 8).....	3	Materia Medica, Therapeutics	
		and Toxicology (Phar. 9).....	4
		Prescription Reading and Dis-	
		pensing (Phar. 10).....	3
		Urinalysis (Phar. 11).....	2
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19		17	



## DESCRIPTION OF WORK IN PHARMACY.

(1) **Introductory Pharmacy.**—This course consists of a study of the authoritative guides; the theory in the use of the common apparatus and processes used in pharmacy; together with practical laboratory training in the use of this apparatus and these processes. Lectures and recitations, 3; laboratory, 1. I, 4.

(2) **Pharmaceutical Problems.**—Two hours per week devoted to the study of the principles of pharmaceutical arithmetic and to practical problems involving weights and measures, relationship of systems, specific gravity and specific volume, reducing and enlarging formulas, percentage solution, concentration and dilution, alligation and thermometric scales. Recitations. I, 2.

(3) **Official Galenical Pharmacy.**—A continuation of course (1) and must be preceded by it; consisting of a thoroughly scientific study of the galenical preparations in the United States Pharmacopoeia and National Formulary. These are carefully considered with regard to classification, nomenclature, mode of preparation, preservation, and percentage composition. Texts, U. S. Pharmacopoeia, eighth revision, and National Formulary, third edition. Lectures and recitations. II, 4.

(4) **Manufacturing Pharmacy.**—A practical laboratory course in which many of the important and difficult medicinal preparations of the U. S. Pharmacopoeia and National Formulary are manufactured by each student, especially the typical representatives of each class of galenicals, viz: waters, liquors, decoctions, infusions, syrups, mucilages, honeys, glycerites, elixirs, spirits, tinctures, wines, vinegars, fluidextracts, extracts, oleoresins, resins, collodions, emulsions, mixtures, pills, powders, granular effervescent salts, cerates, ointments, liniments, oleates, plasters and suppositories. I and II, 4.

(5) **Pharmacognosy.**—A study of the natural history and important features of crude drugs; the means of identification and selection; constituents, and official preparations. The official organic drugs and some of the commonly used non-official ones will be studied in the following order: (a) Plant drugs—Roots, rhizomes, tubers, bulbs, corms, herbs, barks, twigs, woods, leaves, flowers, fruits, seeds, gums, resins, balsams, etc.; (b) Animal drugs. The student has actual access to the typical specimens in the materia medica laboratory. Lectures, recitations, and laboratory exercises. II, 3.

(6) **Pharmacopoeial Salts.**—The official inorganic and organic salts, acids, and the official alkaloids, alkaloidal salts and glucosides are studied with special reference to nomenclature, source, manufacture, physical and chemical properties. Lectures and recitations. I, 5.

(7) **Microscopical Study of Powdered Drugs.**—This course consists of the study of powdered vegetable drugs and their common adulterants by the aid of the microscope. By the preparation of slides and drawings the student learns the most important characteristics of the different

drugs most commonly adulterated and their common adulterants, and is thus enabled to determine questions of identity and purity. Laboratory 2. II, 2.

(8) **Drug Analysis.**—This is chiefly a practical laboratory course in the analysis and standardization of the inorganic medicines, chemicals, organic drugs and preparations, according to the methods of the United States Pharmacopoeia. One recitation and two laboratory periods. I and II, 6.

(9) **Materia Medica, Therapeutics and Toxicology.**—Lectures and recitations on the physical, physiological and therapeutic properties of medicines, together with their classification and dosage. Special attention is also given to methods of detection, antidotes and toxic posology of the more commonly used remedies. I, 4.

(10) **Prescription Reading and Dispensing.**—A technical study of all phases of the prescription, practical exercises at sight reading and in the art of extemporaneous compounding. I, 3.

(11) **Urinalysis.**—Two credits per week devoted to the study and estimation of the constituents of urine in health and disease. II, 2.

(12) **Pharmacy Latin.**—An elementary course in Latin syntax, with a study of Latin pharmaceutical terms. I, 3.

The above subjects with the exception of (12) are listed in proper sequence, and those which precede are prerequisite for those which follow, according to the schedule of the two-year course.

# School of Home Economics and Mechanic Arts

The courses in home economics and mechanic arts are maintained for the benefit of the young women and men who are not convenient to high schools, and especially for those who want industrial training. The large and well equipped laboratories, drawing rooms, kitchens, sewing rooms and shops provide facilities for work that will rank with the best secondary polytechnic schools. The instruction is given by the regular faculty members in their special subjects.

For admission to the courses in home economics and mechanic arts, an eighth grade certificate, or its equivalent, is required. Those not having an eighth grade certificate will pass an examination, or otherwise satisfy the requirements before entering the classes. A liberal course of reading is given in the English classics as a part of the required work. It is desirable, so far as possible, for students to purchase the books and make them a part of their private libraries.

## FOUR-YEAR COURSES.

The four-year courses in home economics and mechanic arts include the ten units required by the State Board of Education for admission to the freshman year of the state institutions as shown on page 15 of this catalog. The remaining units consist for the most part of industrial subjects. A unit consists of work to the amount of four sixty-minute recitation periods per week for a year of thirty-six weeks. Two periods of laboratory, drawing, shop, cooking or sewing shall count as one recitation period. Irregular registration, except as necessitated by a student's previous preparation, is allowed by vote of the faculty only. The courses in English, German and mathematics may be taken only in the order tabulated in the courses.

Military drill is required of the boys and gymnasium practice of the girls in these courses.

Judge F. K. Armstrong of Bozeman gives a prize of ten dollars to the one taking first place in the annual declamatory contest. There is a prize of five dollars for the second best. Only regular students in the four-year courses are eligible to enter this contest.

Hon. Nelson Story, Jr., of Bozeman, gives twenty-five dollars for prizes in extemporaneous speaking. The contestants speak from five to eight minutes. The subjects are selected by them three hours before the contest from a list prepared by a committee of the faculty. Eligibility is the same as in the declamatory contest.

Those who complete the four-year courses in home economics and mechanic arts will be awarded suitable diplomas and are eligible to enter the freshman class of the college. The young women who do not continue their studies will have a practical training which fits them for home making, and which furnishes an excellent preliminary training for the

vocations based upon domestic science and art. The young men who can not continue their studies have a good preliminary training for drafting, the shop, the foundary, and work with steam and gas engines.

### **THE TWO-YEAR COURSES.**

Two-year courses are offered in home economics and mechanic arts. The entrance requirements are the same as for the four-year courses. Only students who have sufficient age and maturity to profit by the work are allowed to register in them. In order that there may be opportunity for specializing, a liberal amount of electives is allowed. The two-year courses contain all the industrial work of the four-year courses, together with English and some mathematics and science. By specializing in one or two lines of work considerable proficiency may be gained and much progress made in the skill necessary to one of several vocations.

**HOME ECONOMICS.****FIRST YEAR.**

First Semester.		Second Semester.	
English Composition (a).....	4	English Composition (a).....	4
Algebra (a).....	4	Algebra (a).....	4
History (a) or (b).....	4	History (a) or (b).....	4
Freehand Drawing (a).....	2	Freehand Drawing (a).....	2
Sewing (a).....	4	Sewing (a).....	4
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	18		18

**SECOND YEAR.**

Rhetoric (b).....	4	Rhetoric (b).....	4
Plane Geometry (c).....	4	Plane Geometry (c).....	4
Biology (a).....	4	Biology (a).....	4
Drawing and Handicraft (b).....	2	Drawing and Handicraft (b).....	2
Cooking (g).....	4	Cooking (g).....	4
	—		—
	18		18

**THIRD YEAR.**

Literature (c).....	4	Literature (c).....	4
Physics (a).....	4	Physics (a).....	4
German (a).....	4	German (a).....	4
Textiles (c).....	2	Dressmaking (b).....	4
The House (i).....	2	Elective.....	2
Elective.....	2		
	—		—
	18		18

**FOURTH YEAR.**

Literature (d).....	4	Literature (d).....	4
German (b).....	4	German (b).....	4
Cooking (h).....	2	Cooking (h).....	2
Algebra (b).....	4	Solid Geometry (d).....	4
Elective.....	4	Elective.....	4
	—		—
	18		18

Electives: Physiology (e), trigonometry (2a), household decoration (8b), vegetable gardening (b), landscape gardening (d), farm dairying (f), poultry (e), music, art, history (a) or (b).



**HOME ECONOMICS.****Short Course.****First Year.**

First Semester.		Second Semester.	
English Composition (a).....	4	English Composition (a).....	4
Freehand Drawing (a).....	2	Freehand Drawing (a).....	2
Sewing (a) .....	4	Sewing (a) .....	4
Cooking (g) .....	4	Cooking (g) .....	4
Elective .....	4	Elective .....	4
<hr/>		<hr/>	
18		18	

Electives: Algebra (a), history (a) or (b), household decoration (8b), farm dairying (f), poultry (e), landscape gardening (e), vegetable gardening (b), music.

**Second Year.**

Rhetoric (b).....	4	Rhetoric (b).....	4
Biology (a).....	4	Biology (a).....	4
Textiles (c).....	2	Dressmaking (h).....	4
The House (i).....	2	Household Management (j).....	2
Cooking (h) .....	2	Elective .....	4
Elective .....	4	<hr/>	
<hr/>		18	

Electives: Geometry (c), drawing and handieraft (b), German (a), farm dairying (f), poultry (e), nursery practice (a), landscape gardening (c), vegetable gardening (h), music.

**MECHANIC ARTS.****FIRST YEAR.**

## First Semester.

English Composition (a).....	4
Algebra (a) .....	4
History (a) or (b).....	4
Mechanical Drawing (a).....	2
Woodwork (a).....	4

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18

## Second Semester.

English Composition (a).....	4
Algebra (a).....	4
History (a) or (b).....	4
Mechanical Drawing (a).....	2
Forge Work (b).....	4

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18**SECOND YEAR.**

Rhetoric (b).....	4
Plane Geometry (c).....	4
German (a).....	4
Mechanical Drawing (b).....	2
Pattern Work (e).....	2
Foundry (d).....	2

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18

Rhetoric (b).....	4
Plane Geometry (c).....	4
German (a).....	4
Mechanical Drawing (b).....	2
Patternwork (e).....	2
Foundry (d).....	2

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18**THIRD YEAR.**

Literature (b).....	4
Physics (a).....	4
German (b).....	4
Mechanical Drawing (c).....	2
Forge Work (c).....	2
Machine Work (f).....	2

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18

Literature (c).....	4
Physics (a).....	4
German (b) .....	4
Mechanical Drawing (c).....	2
Machine Work (f).....	4

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18**FOURTH YEAR.**

Literature (d).....	4
Algebra (b).....	4
Mechanical Design (d).....	4
Machine Work (h).....	2
Steam Boilers and Engines (a)....	4
or Electrical Practice (a).....	4

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18

Literature (d).....	4
Solid Geometry (d).....	4
Mechanical Design (d).....	4
Machine Work (h).....	2
Steam and Gas Engines (b).....	4
or Electrical Practice (a).....	4

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18

**MECHANIC ARTS.****Short Course.****FIRST YEAR.**

First Semester.		Second Semester.	
English Composition (a).....	4	English Composition (a).....	4
Algebra (a).....	4	Algebra (a).....	4
Mechanical Drawing (a).....	4	Mechanical Drawing (b).....	4
Woodwork (a).....	4	Carpentry (a) or Pattern	
Forge Work (b).....	4	Work (e).....	4
		Forge Work (c) or Foundry (d)	4
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**SECOND YEAR.**

English (b).....	4	English (b).....	4
Plane Geometry (c).....	4	Plane Geometry (c).....	4
Mechanical Drawing (c).....	4	Mechanical Drawing (c).....	4
Physics (a) .....	4	Physics (a) .....	4
Elective .....	4	Elective .....	4
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20		20	

Electives: Carpentry, forge, machine work, pattern making, foundry, steam boilers and engines, steam and gas engines.

## DESCRIPTION OF THE WORK.

## ENGLISH.

(a) **English Composition.**—The aim of the course is to secure accurate and effective expression, and to afford constant exercise in composition. In connection with this work English classics will be made the subject of class room study, forming a basis for the study of literature. I and II. 1 unit. M. T. Th. F., 10 to 11.

(b) **Rhetoric.**—This is a continuation of course (a). Each student is required to do considerable written work beside work in the text book. I and II. 1 unit. M. T. Th. F., 10 to 11.

(c) **Literature.**—The object of this course is to develop an intelligent appreciation of American and English masterpieces and to promote a taste for the best literature. A series of classics similar in number and kind to the New English College requirements are the material for critical class room study. The student will find in the library valuable works of reference. Some written work will be required. I and II. 1 unit. M. T. W. Th., 11 to 12.

(d) **Critical Study.**—The purpose of this course is to apply the principles as laid down in composition and rhetoric. It will consist of a study of the classics, writing of themes, oral discussions and library and home reading assignments. I and II. 1 unit. M. T. W. Th., 1 to 2.

The following works are studied in class: Shakespeare's Merchant of Venice, and Macbeth; the Sir Roger de Coverly Papers from the Spectator; Irving's Life of Goldsmith; Coleridge's Ancient Mariner; Scott's Ivanhoe, and the Lady of the Lake; Tennyson's Gareth and Lynette, Lancelot and Elaine, and the Passing of Arthur; Lowell's Vision of Sir Launfal; and George Eliot's Silas Marner.

## MATHEMATICS.

(a) **Algebra.**—This includes the following subjects: Addition, subtraction, multiplication, division, equations of the first degree with one unknown number, simultaneous equations of the first degree, factors, highest common factor, lowest common multiple, quadratic equations, simultaneous equations above the first degree, theory of indices (positive, negative, fractional, and zero), and radicals. I and II. 1 unit. M. W. Th. F., 10 to 11.

(b) **Advanced Algebra.**—Simultaneous quadratic equations; ratio proportion and variation; graphical representation of simple relations between two variables; arithmetical and geometrical progressions; binomial theorem for positive integral exponents; logarithms, including use of tables in simple numerical work. I.  $\frac{1}{2}$  unit. M. T. W. F., 9 to 10.

(c) **Plane Geometry.**—This includes, in addition to the work given in the standard texts, a large number of original exercises. Prerequisite: Algebra (a). II, 1. 1 unit. M. T. W. F., 9 to 10. M. T. W. Th., 1 to 2.

(d) **Solid Geometry.**—In this course special attention is given to the geometry of the sphere. Prerequisite: Algebra (a) and (b) and geometry (c). II.  $\frac{1}{2}$  unit. M. T. W. Th., 1 to 2.

**SCIENCE.**

(a) **Elementary Physics.**—Lectures with experimental illustrations, recitations, assigned problems, and laboratory work four hours per week throughout the year, in mechanics, sound, heat, light, electricity and magnetism. Text book: *A First Course in Physics*, by Millikan & Gale. I and II. 1 unit. M. W. F., 9 to 10; F., 1 to 3.

(a) **Biology.**—This course will be conducted in such manner as to give the pupils a good understanding of the first principles of the science of living things. While the subjects of the course will be taken from the field of zoology and botany, it is not the purpose to train zoologists and botanists. but to equip the pupils, by the information and training given, to observe and interpret simple biological facts. Recitations and laboratory exercises. I and II. 1 unit. I, M. W., 8 to 9; W., 2 to 4. II, M. W., 8 to 9; Th., 2 to 4.

(e) **Elementary Physiology.**—An elementary course in physiology covering the main facts of general anatomy and physiology of the human body. Nutrition, the blood and circulation, respiration, excretion, nervous system and its functions, and the special senses, are among the topics covered. II.  $\frac{3}{8}$  unit. M. T. F., 8 to 9.

**GERMAN.**

(a) **Beginning German.**—The work of the first year includes pronunciation, grammar, selections in prose and verse with practice in speaking and writing German. I and II. 1 unit.

(b) **Second Year German.**—Texts suitable for second year work; for the most part, the writings of contemporary authors. Memorizing of easy colloquial sentences and poems. Conversation and composition. I and II. 1 unit.

**HISTORY.**

(a) **Greek and Roman History.**—The mastery of such a text as West's *Ancient World* or a briefer text on Greek and Roman history. Special attention is paid to the geography of the ancient world, and references to other books and occasional outside topics given to enable the students to grasp the subject rather than memorize the text. When possible, pictures of places or of objects of study are used. I and II. 1 unit. M. T. W. F., 9 to 10.

(b) **Medieval and Modern History.**—The second year is given to medieval and modern history, using the same methods. I and II. 1 unit. M. T. W. Th., 11 to 12.

**DRAWING.**

(a) **Drawing.**—Freehand drawing from geometric solids and casts. Study of light and shade. Object drawing, in charcoal, pencil, and pen and ink. Study of linear perspective with practical exercises in perspective sketching. I and II.  $\frac{1}{2}$  unit. M. W., 1 to 3.

(b) **Continuation of Course (a).**—Study of design and handicraft at discretion of instructors. I and II.  $\frac{1}{2}$  unit. M., 2 to 4; Th., 8 to 10.



**HOME ECONOMICS.**

(a) **Sewing.**—The fundamental principles of hand and machine sewing applied to the making of aprons and undergarments—students provide suitable materials. The finished work is the property of the student. I and II. 1 unit. F., 10 to 11; Th., 8 to 10.

(b) **Dressmaking.**—Designing, cutting and making simple dresses is a part of the work. II.  $\frac{1}{2}$  unit. T. Th., 8 to 10.

(c) **Textiles.**—A study of cotton, wool, silk and linen in regard to its microscopical structure, physical properties, manner of growth, and manufacture into cloth. Simple tests for adulteration are discussed. Sample note book is kept. I.  $\frac{1}{4}$  unit.

(g) **Cooking.**—The object of the course is to teach plain cooking breads, meats, eggs, cereals, soups, salads, preserving fruits, cakes, candy and simple desserts. Some attention is given to invalid cookery. Visits to the meat market to study cuts of meat. The students are shown how biology and chemistry apply to the preparation of foods. Williams and Fisher's text book, *The Elements of the Theory and Practice of Cookery*, is used. Lecture, 2; laboratory, 2. I and II. 1 unit.

(h) **Cooking.**—A continuation of course (g). Attention is given to table setting and the preparation of meals. I and II.  $\frac{1}{2}$  unit.

(i) **The House.**—A study of the evolution of the house; the surroundings, situation and plan of the house, heating, lighting, plumbing and drainage. Lectures on house furnishings, exercises in making skeleton plans of small houses. The text book used is *The House*, by Miss Bevier. I,  $\frac{1}{4}$  unit.

(j) **Household Management.**—This course deals with the organization of the household, expenditure of income, and the planning and selection of equipment and furnishings of the house. II.  $\frac{1}{4}$  unit. M. W., 8 to 9.

**MECHANICAL DRAWING AND DESIGN.**

Before beginning work, a student must provide himself with one of the following sets of drawing instruments or a set of equal quality: K. & E. No. 896 NCP with No. 523 $\frac{1}{2}$  pen or Dietzgen No. 937 C with No. 508 pen.

(a) **Mechanical Drawing.**—Lettering. The shape and proportions of letters, freehand construction. Geometrical construction, freehand sketching of simple machine parts, reproduced in detailed working drawings; orthographic projection in the third quadrant. I and II.  $\frac{1}{2}$  unit.

(b) **Mechanical Drawing.**—A continuation of (a) in machine and architectural detail drawing, tracing and blue-printing; isometric and cabinet projection; intersectons and development of surfaces with applications in roof framing and sheet-metal work. I and II.  $\frac{1}{2}$  unit.

(c) **Mechanical Drawing.**—Machine drawing and the elementary principles of mechanism; screws threads, screws and bolts; pulleys and

belting; gear tooth curves, gears in train, change gears. I and II.  $\frac{1}{2}$  unit.

(d) **Mechanical Design.**—Machine drawn and elementary design, covering bearings and journals, spur, bevel and screw gears, differentials and change speed mechanism, engine parts, quick returns, punches, shears, presses. Two hours recitation, four hours drawing. I and II. 1 unit.

### SHOP WORK.

Deposits for shop work will be made as follows:

Wood Work, Foundry, Machine Work, per credit, per semester.....	\$1.00
Forge Work, per credit, per semester.....	1.50
Steam and Gas Engine (b).....	2.00

(a) **Wood Work.**—Joinery, consisting of a series of exercises designed to develop skill in the use and care of bench tools, and proficiency in reading simple working drawings. Turning, comprising spindle, face plate and chuck work in the manufacture of simple patterns and standard articles for shop use. House carpentry, illustrating the methods and principles of framing, rafter and stair cutting, mill work and finishing. Cabinet work, in which standard wood shop machinery is used in the manufacture of drawing tables, book and filing cases, office desks and other plain furniture, and including finishing in oil, stain, wax and varnish. I,  $\frac{1}{2}$  unit.

(b) **Forge Work.**—The operation of hand and power forges and manipulations of the fire, with progressive exercises in iron forging designed to teach the operations of drawing, upsetting, bending, forming and welding. The work of the second semester includes the forging and welding of mild and tool steels, as well as the hardening and tempering of simple hand tools. II.  $\frac{1}{2}$  unit.

(c) **Forge Work.**—A continuation of (b) in forging and tempering hand tools, lathe tools, foundry tools, springs, drills and reamers, including annealing and case-hardening. I.  $\frac{1}{4}$  unit.

(d) **Foundry.**—A course in bench and floor moulding in green sand. Castings in white metal, brass and cast iron are poured for use in the machine shop. I and II.  $\frac{1}{2}$  unit.

(e) **Pattern Making.**—Instruction in the methods of making proper allowances on patterns for draft, shrinkage and finish, and practice in the construction of patterns for pulleys, hangers, machine parts and pipe fittings, with the necessary core boxes. I and II.  $\frac{1}{2}$  unit.

(f) **Machine Work.**—Bench work, including chipping, filing, scraping, fitting, soldering, brazing, and babbitting. Machine tool work on drill press, shaper, planer and lathe. I and II.  $\frac{3}{4}$  unit.

(h) **Machine Work.**—Students choosing this subject are given advanced work on lathe, milling machine and grinder, with practice in hardening and tempering taps, dies, cutters and high speed steels. I and II.  $\frac{1}{2}$  unit.

**STEAM BOILERS AND ENGINES.**

(a) **Steam Boilers and Practice.**—The construction and operation of steam boilers, and their auxiliaries, including the care of boilers, their strength and evaporative capacity, the physical properties of steam, combustion of fuel, pumps, injectors, feed water heaters, condensers. Prerequisites, physics, mechanical drawing (a), (b), and machine work (f). I,  $\frac{1}{2}$  unit.

(b) **Steam and Gasoline Engines.**—The construction and operation of steam and gasoline engines and tractors, valves and valve gears, governors; lubricators; indicator cards, indicated horse power, brake horse power, efficiency. Prerequisite, steam boilers (a). II.  $\frac{1}{2}$  unit.

**ELECTRICAL PRACTICE.**

(a) **Electrical Practice.**—Elementary principles of electricity, electric wiring, management and care of electrical machines and apparatus, including dynamos and motors, batteries, electric lights, telephones and telegraph apparatus. Text book: Essentials of Electricity, by Timbie. Prerequisite: Physics (a). Lectures and recitations per week. I and II.  $\frac{3}{4}$  unit.

## School of Agriculture

The School of Agriculture has for its specific purpose the training of the younger generation in such a way that the term "farming" will mean a pleasure and a profitable source of income rather than the much dreaded drudgery as thought of at present. Much of the instruction is of a practical nature and the student is brought into actual contact with the problems connected with farm life.

The course extends through three years of six months each and comes in the winter season when the young people can be spared from farm work. For entrance to this course, students must have passed the eighth grade or its equivalent, otherwise they shall be required to pass an entrance examination or give satisfactory evidence to the agricultural committee that they are capable of carrying on the work. Young men 21 years of age and over will be admitted to the course without having completed the eighth grade in the public school, provided they have had some practical experience upon the farm and possess a fair common school education. Those who satisfactorily complete the course will be given diplomas.

A general fee of \$6.00 is charged all students upon entering the course. This fee is not returnable unless students are honorably dismissed early in the year on account of sickness or other reason satisfactory to the faculty. A laboratory fee of \$2.00 per semester is required in dairying, and \$1.00 per semester in biology. The shop deposit is \$4.00 per semester in woodworking, and \$6.00 per semester in blacksmithing.

In several of the courses these deposits are made to insure against breakage of equipment by the students taking the work, and the careful student is able to secure a return of at least a part of his deposit when he completes the course.

The total cost to the student will be about \$150 to \$175. This will include board, room, text books, etc.

Students in this course have the privilege of studying a modern dairy in operation, including types of the best breeds of dairy cattle; a complete poultry plant, containing breeds illustrating especially the best laying strains and market fowls; modern grain and soil laboratories; model farm buildings and barns, with pure bred live stock; the experiment station farm; greenhouses and orchards; the large biological, chemical and physical laboratories; and the well equipped wood and iron shops of the engineering department. The methods employed are practical. The instruction is supplemented with practice in the laboratories, the dairy, the orchards, the greenhouses, and with the herds. As far as practicable, visits are also made to other farms and herds in the neighborhood.

The variety of animals included upon the farm affords ample oppor-

tunity to see the various diseases, injuries, etc., encountered in farm animals. In the veterinary building there is provided a clinic room, where sick and injured animals are treated, and the student is given the benefit of these demonstrations.

## COURSE IN SCHOOL OF AGRICULTURE.

## FIRST YEAR.

## First Semester.

English Composition (Eng. f.).....	2
Animal Types (An. Ind. a).....	2
Nursery Practice (Hort. a).....	3
Farm Dairy (An. Ind. f).....	4
Physics (Phys. b).....	5
Carpentry (Mech. Arts a).....	4
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## Second Semester.

English Composition (Eng. f).....	2
Animal Types (An. Ind. b).....	2
Poultry (An. Ind. e).....	4
Vegetable Gardening (Hort. b)....	3
Chemistry (Chem. a).....	5
Blacksmithing (Mech. Arts b).....	4
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## SECOND YEAR.

Rhetoric (Eng. g).....	2
Breed Types (An. Ind. c).....	3
Orcharding (Hort. c).....	3
Botany (Biol. b).....	4
Farm Machinery (Agron. f).....	4
Field Crops (Agron. a).....	4
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Rhetoric (Eng. g).....	2
Breed Types (An. Ind. d).....	3
Irrigation and Drainage (Agron. g).....	2
Entomology (Biol. d) .....	4
Plant Diseases (Biol. c).....	4
Field Crops (Agron. b).....	4
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## THIRD YEAR.

Literature (Eng. h).....	2
Feeding and Management of Live Stock (An. Ind. g).....	3
Landscape Gardening (Hort. c) 3	
Soil Physics (Agron. e).....	3
Principles of Breeding (An. Ind. i).....	3
Common Diseases (Vet. Sci. a)....	3
Grain Judging (Agron. b).....	2
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	19

Literature (Eng. h).....	2
Feeding and Management of Live Stock (An. Ind. h).....	3
Dairy Manufacture (An. Ind. j) 3	
Soil Fertility (Agron. d).....	3
Farm Management (Agron. e).....	3
Common Diseases (Vet. Sci. a)....	3
Traction Engineering (Agron. j) 3	
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**AGRONOMY.**

(a) **Field Crops.**—This course includes a study of the methods of growing and producing oats, wheat, flax, rye and corn. First semester, 4 credits, 3 lectures, 1 laboratory. Prerequisite: Biology (b).

(b) **Field Crops.**—This includes a study of all forage crops and grasses. Second semester, 4 credits, 3 lectures and 1 laboratory. Prerequisites: Biology (c) and agronomy (a).

(c) **Soil Physics.**—A review of the study of the formation of soils and a study of the methods of maintaining the physical conditions of the soil. First semester, 3 credits, 3 lectures. Prerequisite: Physics (b), chemistry (a) and agronomy (b).

(d) **Soil Fertility.**—Soil fertility includes a study of the methods of maintaining the fertility of the soil, especially in this state, as well as a study of the different methods of handling the farm yard manure and the rotation of crops. Second semester, 3 credits. Prerequisites: Agronomy (c), chemistry (a) and agronomy (b).

(e) **Farm Management.**—In this course students are taught the practical methods of managing a farm. Second semester, 3 credits. Prerequisite: Agronomy (c).

(f) **Farm Machinery.**—This course includes a study of the various types of farm machinery. Special emphasis is laid on the selection, adjustment and care of farm machinery. The course will also include instruction on the modern farm conveniences, such as telephone, water supply systems, etc. Prerequisite: Physics. 4 credits, first semester, second year.

(g) **Irrigation and Drainage.**—Includes a study of the different methods of irrigating and draining land. Second semester, 2 credits. Prerequisite: Physics (b).

(h) **Grain Judging.**—In this course students are given practical work in judging the different grains. First semester, 2 credits, 2 laboratories. Prerequisites: Agronomy (a) and (b).

(i) **Traction Engineering.**—This course takes up the various forms of farm motors. Special attention is given to the operation of traction engines. The course is designed to enable the students to operate both steam and gasoline engines intelligently and at minimum expense. Prerequisites: Physics, agronomy (f). 3 credits, second semester of third year.

**ANIMAL INDUSTRY.**

(a) **Animal Types.**—A study of the market types of cattle and sheep. First semester, 2 credits, 2 laboratories.

(b) **Animal Types.**—Judging of the market types of dairy cattle, horses and swine. Second semester, 2 credits, 2 laboratories.

(c) **Breed Types.**—Includes a study of the breed types of cattle and sheep. First semester, 3 credits, 1 lecture and 2 laboratories. Prerequisites: Animal industry (a) or (b).

(d) **Breed Types.**—Includes a study of the breed types of dairy cattle, horses and swine. Second semester, 3 credits, 1 lecture and 2 laboratories. Prerequisite: Animal industry (a) or (b).

(e) **Poultry.**—This course includes a study of the breed types and the management of poultry. Second semester, 4 credits, 2 lectures and 2 laboratories.

(f) **Farm Dairying.**—Includes a study of the methods of handling cream and butter upon a small dairy farm. First semester, 4 credits, 2 lectures and 2 laboratories.

(g) **Feeding and Management of Live Stock.**—In this course the students receive instruction as to the different methods of feeding and managing cattle and sheep. They are also taught the different methods by which these animals are prepared for the show ring. First semester, 3 credits, 2 lectures and 1 laboratory. Prerequisites: Animal industry (c) and (d).

(h) **Feeding and Management of Live Stock.**—A study of the methods of feeding, showing and managing horses and hogs. Second semester, 3 credits, 1 lecture and 2 laboratories. Prerequisites: Animal industry (c) and (d).

(i) **Principles of Breeding.**—This course includes a study of the principles of breeding as directly applied to the farm. Cross breeding, inbreeding and line breeding are taken up. First semester, 3 credits. Prerequisite: Animal industry (c) and (d).

(j) **Dairy Manufacture.**—This course includes a study of the creamery methods of making butter and cheese. Second semester, 3 credits, 1 lecture and 2 laboratories. Prerequisite: Animal industry (f).

### VETERINARY SCIENCE.

(a) **Common Diseases.**—The aim in this course is to first give the student lectures upon the physiology of the digestive, respiratory and blood vascular systems in order to prepare him for a more comprehensive study of the common diseases. It also includes a study of the various kinds of wounds and their treatment, general conformation and care of the teeth and some of the more common ailments in all species of domestic animals. During the second semester, lectures will be given on the care and handling of breeding animals and accidents and diseases attendant upon parturition. 3 credits each semester.

### HORTICULTURE.

(a) **Nursery Practice.**—This study deals with the propagation of fruit and ornamental plants for both home and orchard purposes. First semester, 3 credits.

(b) **Vegetable Gardening.**—This course takes up a study of the methods of growing vegetables, hot bed construction and management, and the different methods of gathering and marketing vegetables and fruits. Second semester, 3 credits.

(c) **Orcharding.**—Methods of growing and handling trees and small fruits are studied. First semester, 3 credits. Prerequisite: Horticulture (a) or (b).

(d) **Landscape Gardening.**—In this course particular attention is given to the study of plans for laying out and mapping farm homes, as well as to a study of the different trees, shrubs and flowering plants that are suitable for Montana. First semester, 3 credits. Prerequisites: Horticulture (a) or (b).

### BIOLOGY.

(b) **Botany.**—The elements of botany are taken up, especially with a view to the needs of agricultural students. The classification, structure, physiology and ecology of plants, are briefly covered. Special attention is given to farm weeds. First semester, 4 credits, 3 lectures, and 1 laboratory.

(c) **Plant Diseases.**—Special attention is given to the recognition of the more important diseases of cultivated plants and the methods of controlling them. This work is conducted upon a scientific basis, but at all times the needs of the practical agriculturist are kept in view. Second semester, 4 credits, 2 lectures and 2 laboratories.

(d) **Entomology.**—After a very brief survey of the animal kingdom the anatomy, physiology, habits, transformations, and classification of insects are studied, together with the methods for controlling injurious species. This course is designed, in a comprehensive manner, to prepare the student for defense against the various insect pests of the farm, orchard and garden. Second semester, 4 credits, 3 lectures and 1 laboratory.

### PHYSICS.

(b) **Elementary Physics.**—Includes experimental lectures, recitations and assigned problems on mechanics, heat, light and electricity. Emphasis will be placed upon those subjects that have a direct bearing on applied agriculture. First semester, 5 credits.

### CHEMISTRY.

(a) **Elementary Chemistry.**—Includes a study of the fundamental principles of chemistry and their relation to agriculture. Second semester, 5 credits.

### MECHANIC ARTS.

(a) **Carpentry.**—The use and care of carpentry tools. A series of exercises in joinery, followed by practice in framing and rafter and stair cutting. First semester, 4 credits, 4 laboratories.

(b) **Blacksmithing.**—Care and manipulation of fire, iron forging, including the operation of drawing, upsetting, pointing, bending, welding, calculation of stock; implement repairs, plow pointing, manufacture of chains, hooks, clevises, clips, etc. Second semester, 4 credits, 4 laboratories.

**ENGLISH.**

(f) **English Composition.**—The first year is devoted largely to practice in the simpler forms of composition, letter writing, simple narrative and exposition; and considerable time is given to reading aloud, black-board work and informal discussion, with attention to correct speech. First and second semesters; 2 credits each semester.

(g) **Rhetoric.**—During the second year more advanced work is given in composition, with frequent themes, reviews, etc. A few masterpieces are read as a basis for a careful study of good style. First and second semesters; 2 credits each semester.

(h) **Literature.**—During this year a more systematic study of several authors is attempted. For the year 1913-1914 the time will be given to Irving, Hawthorne, Emerson and Longfellow. A considerable amount of writing in several different forms is required. First and second semesters; 2 credits each semester.

## School of Music

PAUL P. McNEELY, Mus. B. (Washburn College); A. B. (University of Kansas; Lhevinne, Berlin.

Director of School of Music and Instructor in Piano and Musical Theory.

U. HOLMES BISHOP (New England Conservatory of Music.)

Instructor in Voice and Conductor of Singing Organizations.

FRED O. JACKSON (National Conservatory of Music).

Instructor in Violin and Conductor of Orchestra).

MISS H. BLANCHE McNEELY (Missouri Valley College); (Lhevinne, Berlin).

Assistant Instructor in Piano and Organ.

LOUIS L. HOWARD (Boston Conservatory of Music).

Director of Band and Instructor in Band Instruments.)

### ADVANTAGES OF COLLEGE INSTRUCTION.

The advantages of college over private instruction are very numerous and quite obvious to any one giving the matter serious thought. When a student is seeking the services of a private teacher, he must form his judgment as best he can on that person's fitness for his vocation, while it is certain that the teachers of a successful college are selected mainly on account of their ability, as it would not be in the best interests of such an institution to sacrifice its reputation by employing other than good teachers. Again, the stimulating atmosphere of a music school is another distinct advantage over private instruction.

The music departments are organized for a four-fold purpose:

1. To combine music and literary studies as a broad basis for regular collegiate instruction.
2. To use the art of music for intellectual, esthetic, and moral culture.
3. To teach all branches of music to special and general students.
4. To educate teachers of music.

### DEPARTMENTS OF INSTRUCTION.

- I. Course for the pianoforte.
- II. Course for the voice.
- III. Course for the violin.
- IV. Course for the organ.
- V. Course for harmony, counterpoint, analysis, and history of music.
- VI. Course for orchestral and band music.
- VII. Instruction in chorus singing.

### GENERAL INFORMATION.

1. No time limit can be designated for the satisfactory completion of any course on account of difference in degree of musical ability;



much also depends upon the preparation made, and upon the amount of time and careful attention the student can devote to the pursuit of a chosen study.

2. Students who present themselves as candidates for graduation must have completed a high school course or its equivalent and give evidence of a requisite musical talent and capacity. Each student must give during the last year of study one public recital in addition to the final performance at the commencement concert. Students preparing for graduation are required to take two private lessons a week for two years at least with the head teacher of the department, and it is necessary that resident students should study with teachers of the college for at least two years.

3. For graduation, four semesters' work in harmony will be required, and one year in the history of music, and a thesis.

4. The study of music has been placed upon an equality with other electives, and a limited number of credits may be counted toward a degree.

5. Diplomas will be granted to students who have done satisfactory work and passed the required examinations.

6. Tuition rates are payable in advance for each term of twelve weeks. No reduction will be made for temporary absence from lessons or for lessons discontinued. Lessons missed by the teacher will be made up at the mutual convenience of teacher and pupil.

7. All college students who take work in music shall be enrolled in at least twelve credits of work (including, if so assigned, work in harmony and musical history) in addition to the work in vocal and instrumental music. Students residing at home may be excused by the faculty from such requirements, upon request of their parents. Work is recommended in home economics, languages, literature, history and art.

Students not candidates for a preparatory diploma or a college degree, who are taking music in combination with other work of the college, shall be registered by the head of the department of home economics.

Those students not taking other college work are classed as "Music Specials."

8. The department is closed on the college and national holidays. Lessons falling on these days will not be made up.

9. No student is permitted to take part in any public performance without consent of the director.

10. Tuition fees are subject to change from year to year.

### EQUIPMENT.

The School of Music of the college occupies half of the third floor of College Hall. The large assembly room is used for recitals. The school is well equipped with pianos, both grand and upright.

### CONCERTS AND RECITALS.

Concerts are frequently given by the instructors and advanced students.

Recitals are given bi-monthly by the students of the school, at which work studied in the class room is performed before a small audience of fellow students and friends. Every student is required to take part in the programs at least twice a year. These semi-public appearances are of great assistance in enabling the student to acquire the ease and self-possession so essential to a successful public performance.

### ENSEMBLE AND SIGHT PLAYING.

In this branch of instruction lie indispensable elements of musical culture, to be obtained through no other mode of training.

Ensemble training develops the pupils' ability in reading at sight, and enables them to acquire a knowledge of compositions ordinarily inaccessible to the pianoforte student.

Prima-vista reading of four-hand arrangements, and transcriptions of the symphonies, operas, string quartettes and chamber music generally, for two pianos, are studied. Piano accompaniment playing for voice, violin and other solo instruments receives special attention.

During the year, one or more ensemble recitals are given.

### PIANO DEPARTMENT.

The regular course in piano-forte is covered by five grades, Preparatory, Freshman, Sophomore, Junior and Senior; and the Post Graduate course by one. Examinations will be held twice a year—at the end of each semester. Regular students may not pass from any grade without examination. While it is not obligatory for students to take these examinations, yet they are encouraged to take them because they have something definite before them, their ambition is stimulated and a better quality of study is secured. The pieces used for these examinations will be chosen from a list arranged by the director of the music department.

Special attention will be paid to the following points in the examinations:

Excellence of technique.

Accuracy of notation and correctness of fingering.

Phrasing and rhythm.

Discretion in use of pedals.

Choice of tempo and steadiness in time.

Quality of touch and tone.

Artistic interpretation.

Memory playing.

### PREPARATORY PIANO COURSE.

Technical exercises—Hanon and later Phillipps, throughout all courses.

Czerny-Germer, Studies II; Duvernoy, School of Mechanism, op. 120; Koehler, op. 50; Heller, op. 45 and 47; Kuhlau's *Kinderleben*; Sonatas by Clementi and Kuhlau.

### COLLEGIATE PIANO COURSE.

#### Freshman Examinations.

Candidates must be prepared to play from memory six pieces or sonatas, such as Mendelssohn's *Songs without Words*; Schubert's *Impromptus*; Sonatas by Haydn and Mozart; or other appropriate selections from classic and modern compositions.

**Technic.**—All scales, hands together, in quarter, eighth, and sixteenth, separately, staccato and legato; triads in all keys; arpeggios in three positions, hands separately.

**Studies.**—Czerny, School of Velocity; Cramer, Studies; Bach, Two-part Inventions, and French Suites.

#### Sophomore Examinations.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, and one number of the eight must be prepared without assistance.

Appropriate selections from classic and modern compositions will be studied including Beethoven's Sonatas; Concertos by Mozart, Hummel, etc.

**Technic.**—All scales, hands together, in quarter, eighth and sixteenth notes, metronome at 69. Triads and four-note chords with different touches. Arpeggios formed on all major and minor triads with their inversions, metronome at 84, hands separately. Staccato octaves in any scale required.

**Studies.**—Cramer, Studies, continued; Clementi, Selections from *Gradus ad Parnassum*; Jansen, op. 32; Bach, Three-part Inventions and English Suites.

#### Junior Examinations.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number of the eight must be prepared without assistance.

Concert selections from classic and modern composers will be studied including Chopin's Preludes; Bach, Well-Tempered Clavichord; Concertos by Beethoven, Mendelssohn, etc. Selections from Henselt's op. 2 and 5.

**Technic.**—Major and minor scales, hands together, similar and contrary motion, metronome at 105. Also major scales, hands together in thirds, sixths, and tenths, metronome at 100. All chord forms. Arpeggios formed on the major and minor chords and on the diminished seventh chords, with inversions, metronome at 92. Staccato octaves in major and minor keys, hands together.

**Studies.**—Gradus continued; Moscheles, Etudes, op. 70; Kullak, School of Octaves; Chopin, Etudes.

### Senior Examinations.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number must be a concerto. One number of the eight must be prepared without assistance.

Concert selections from Schumann's greatest works (David, Bunder-Tanze or Carnaval); Sonatas and Concertos by Beethoven, von Weber, Grieg, etc., and pieces by modern composers.

**Technic.**—All major and minor scales in octaves, tenths, sixths, and thirds, metronome at 120. Scales must also be played with crescendos and diminuendos, two notes against three, and three notes against four. All chord forms, solid and broken, with any touch required. Arpeggios formed on all major and minor chords, also the dominant seventh, and diminished seventh chords, all with inversions, metronome at 108. All octave forms will be required.

**Studies.**—Chopin's Etudes, op. 10 and 25; Rubinstein, Selected Studies; Bach, Well-tempered Clavichord, continued.

### Post Graduate Examinations.

Candidates must be prepared to play eight numbers selected by the instructor. One post graduate number of the eight must be prepared by the candidate without assistance.

The most advanced works in the piano repertory will be studied, as Chopin's etudes and Godowski's arrangement of same; modern etudes by Liszt, McDowell, Moszkowsky, etc. Transcriptions of Bach's organ pieces by Liszt, Busoni, etc.; Schumann's Etudes Symphonies or a set of Brahms' Variations; concert pieces and concertos by modern composers.

**Technic.**—All scales in similar and contrary motion, the legato in quarter, eighth, and sixteenth notes; staccato (hand and finger touch) in quarter and eighth notes, metronome at 176. All chord forms, solid and broken, metronome at 160. Arpeggios on all major and minor chords; also dominant seventh chords, with inversions, the legato in quarter, eighth and sixteenth notes; staccato (hand and finger touches) in quarter and eighth notes. The seventh chords to be played also in triplet rhythms, metronome 176. Octaves in major, minor and chromatic scales, hand together, in similar motion, with any variety of touch required. The staccato in quarter, eighth and sixteenth notes; the legato and arm touches in quarter and eighth notes only. All major, harmonic, minor and chromatic scales in double thirds, fourths and sixths legato and staccato.

**MUSICAL THEORY.**

The courses in Harmony presupposes a thorough knowledge of the rudiments of music and some proficiency in piano playing.

The following courses are required of all students in the regular musical courses, excepting courses 5 to 9, which are optional.

(1) **Harmony.**—The study of overtones, scales, intervals, triads, and seventh chords and their inversions. The practical work consists of harmonizing melodies in soprano or bass and playing chord progressions at the piano. First year, twice a week first semester.

(2) **Harmony.**—The study of close and open harmony, dominant ninth and diminished seventh chords, modulations. Practical work continued. First year, twice a week, second semester.

(3) **Harmony.**—The study of modulation, irregular resolutions, altered chords, suspensions, passing tones, organ point, harmonization of florid melodies. Practical work continued. Second year, twice a week, first semester.

(4) **Musical Analysis.**—Review of harmony, analysis of two and three part song and song with trio. Classical models with original work. Second year, twice a week, second semester.

(5) **Counterpoint.**—The different orders of single counterpoint in two, three, and four parts. Third year, once a week, first semester.

(6) **Counterpoint.**—Double and triple counterpoint. Counterpoint in the twelfth and fifteenth and in more than four parts. Modern counterpoint. Third year, once a week, second semester.

(7) **Musical Composition.**—The theme and variation, dance and song forms. Analysis of classical models and practical work. Third year, first semester.

(8) **Musical Composition.**—The sonata and rondo forms; analysis of classical sonatas; original work. Third year, second semester.

(9) **Musical History.**—A survey of music from the earliest times. Lectures, discussions, and assigned readings. First year, once a week, first semester.

(10) **Musical History.**—This course deals principally with modern music. Lectures, reports and class discussions. First year, once a week, second semester.

(11) **Thesis.**—All candidates for graduation in any department of the School of Music must write a creditable thesis on some phase of music or the other allied arts.

**VOCAL DEPARTMENT.**

Instruction in this department aims to develop a high musical taste and ability in the singer, as well as in the voice. Along the course of study is voice placement, vowel study and their application to words; rhythm, phrasing, enunciation, and song interpretation. Songs are selected from the works of the best writers, both foreign and native. Studies in vocalization include works of Conecne, Vaccai, Sieber, Marchesi, Lutgen, etc.



No student of the vocal art can reasonably expect to achieve any great degree of proficiency without a certain amount of general culture. To this end, harmony should be studied; languages, especially German, French and Italian; a good command of English is necessary; chorus work is of an almost indispensable value; and every singer should be able to play on the piano song accompaniment of moderate difficulty.

Candidates for graduation must have completed an accredited high school course or its equivalent; must be able to sing intervals, scales, arpeggios and sustained tones; must have completed one year each of harmony and history of music; two years each of French and German languages and one year of Italian for which Spanish may be substituted; two years of piano (secondary); two years of chorus if required; and must be able to read at sight with a reasonable degree of accuracy. The repertoire should be extensive so as to include compositions of the French, German and Italian masters, as well as those of the English and American writers of note.

**Chorus.**—The choruses are the Male Glee Club and the Ladies Glee Club. The aim of these organizations is to promote college life and spirit and give the students opportunity to develop musically. From time to time public exhibitions are given of the works studied.

**Male Glee Club.**—Men students who have the necessary range and quality of voice are admitted. Music and instruction is free. Rehearsals are held twice a week under the direction of the instructor of vocal music. College and home songs as well as the works of the foremost American composers are studied.

**Ladies' Glee Club.**—This club consists of sixteen voices, otherwise it corresponds with the Male Glee Club. The same type of music is studied, and the rehearsals are held twice a week. Twice a year the clubs appear in joint concerts performing the works studied, and forming also a mixed chorus. Separate appearances are frequent.

### VIOLIN DEPARTMENT.

The work of the violin department is covered by five grades. Preparatory, Freshman, Sophomore, Junior, and Senior. Examinations will be held twice a year at the end of each semester and it will be necessary for the students to play six major and their relative minor scales in one, two, and three octaves, according to the grade of the student. Also one study selected by the instructor on day of examination and one study prepared by the student.

#### Preparatory Violin Course.

Dancla; Conservatory Method, Books I and II; Dancla, School of Velocity; Schradieck, Major and Minor Scales in one octave; Dancla and Mazas, Special Sight-reading Duos.

### Collegiate Violin Course.

#### Freshman.

**Technic.**—Scales in two octaves. Scales in double stopping thirds and sixths.

**Studies.**—Mazas, *Etudes Speciales*, Book I; Schradieck, *Exercises to increase firmness in different positions*; Dancla, op. 122; Hans Litt, op. 32, Book II; ensemble playing.

#### Sophomore.

**Technic.**—Scales in three octaves, double stopping in thirds, sixths and octaves.

**Studies.**—Mazas, *Etudes Brilliantes*, Book II; Schradieck exercises for double stopping, Book II; *Etudes* by Singer, Allard, David, interspersed with compositions of Raff, Beethoven, Dancla, Bohm, etc. Ensemble playing.

#### Junior.

**Technic.**—Scales in three octaves. Scales in double stopping in thirds, sixths, octaves and tenths.

**Studies.**—Mazas, *Etudes d'Artistes*, Book III; Hans Sitt, op. 80. Twenty-four studies in different keys (preparatory to Kruetzer Studies); Kreutzer, *Forty-two Studies*; Compositions by DeBeriot, Bach, David, Vieux temps, etc.; Sonatas by Mozart. Ensemble work from the best masters.

#### Seniors.

**Technic.**—Scales in three octaves. All double stops and chromatics.

**Studies.**—Rode, *Twenty-four caprices*; Florillo, *Thirty-six Etudes*; Compositions by Mendelssohn, Dvorak, Brahms, Moszkowski, etc. Sonatas by Beethoven. Ensemble playing from the best masters.

**The Orchestra.**—All violin students who are sufficiently advanced are admitted to the College Orchestra and in as much as the orchestra is under the personal direction of the violin instructor it is of a decided advantage to the violin students.

**Ensemble.**—In this department, sonatas for piano, and violin by Bach, Beethoven, Mendelssohn, Schumann, Mozart, Hayden, Schubert, Grieg, Rubenstein and others are used; also many classical compositions of different forms. This department is open to advanced piano students only.

### CALENDAR FOR 1913-14.

The music department has divided the year into three terms of twelve weeks each, or if desired, lessons may be arranged by the College semester.

1913—September 8: Fall term registration begins.

—December 3: Fall term closes.

—December 4: Winter term begins.

1914—March 11: Winter term closes.

—March 12: Spring term begins.

—June 3: Spring term closes.

**TUITION.****With Mr. McNeely.**

For one forty-five minute lesson per week for one term.....	\$25.00
For two half-hour lessons per week for one term.....	32.00
Harmony, for the entire academic year (two lessons a week).....	20.00

**With Miss McNeely.**

For one forty-five minute lesson per week for one term.....	\$18.00
For two half-hour lessons per week for one term.....	22.00
Organ, one hour lesson per week for one term.....	24.00

**With Mr. Bishop.**

One forty-five minute lesson per week for one term.....	\$27.00
Two half-hour lessons per week for one term.....	36.00

**With Mr. Jackson.**

For one forty-five minute lesson per week for one term.....	\$18.00
For two half-hour lessons per week for one term.....	25.00
For one hour ensemble lesson per week for one term.....	18.00

Students wishing to arrange for vocal or instrumental instruction by the single lesson instead of by the term will be charged \$1.50 per half-hour lesson.

Piano practice may be arranged for at the following prices:

One hour each day 30 cents per week.

Organ practice: One hour each day, 25 cents.

# Alumni

**With their Years, Degrees and Present Addresses and Occupations.**

- Allen, Elbert, B. S., 1903; Attorney at Law, Livingston, Mont.
- Alward, Mary L., B. S., 1908; Teacher in Gallatin County High School, Bozeman, Montana.
- Annin, James T., B. S. 1911; Part owner Columbus News, Columbus, Montana.
- Baker, Florence, B. S. 1912; Teacher in Public Schools, Portland, Oregon.
- Baker, Harold E., B. E. E. 1907; Superintendent Electric Power Co., Naches, Washington.
- Baneroft, Raymond E., B. S. 1911; Fruit and Orchard Inspector, Billings, Montana.
- Barnard, Robert B., B. S. 1910; Salesman Westinghouse Electric Co., Butte, Montana.
- Bell, James C., B. S. 1911; Superintendent of Fruit Farm, Bitter Root Valley, Darby, Montana.
- Benton, Ralph, B. S. 1906; Associate Professor of Applied Biology, University of Southern California, Los Angeles.
- Blessing, John, B. S., 1912; Commercial Orchardng, Bitter Root Valley, Corvallis, Montana.
- Bole, William S., B. S., 1906; Physician and County Health Officer of Cascade County, Great Falls, Montana.
- Booker, Clinton T., B. S., 1911; Electrical Engineer Great Falls Power Company, Great Falls, Montana.
- Blankenship, E. V., B. S., 1897; Farming and Stock Raising, Bozeman, Montana.
- Brewer, Lucille, B. S., 1909; Matron Woman's Hall, University of Montana, Missoula, Montana.
- Breneman, Annie T., B. S., 1907; Instructor in Mathematics, Teton County High School, Choteau, Montana.
- Brown, Archie S., B. S., 1910; Electrical Expert, Bremerton Navy Yards, Bremerton, Washington.
- Brown, Edith E., B. S., 1904; Mrs. John Milloy, Regina, Canada.
- Bull, Edna, B. S., 1909; Mrs. W. G. Kirscher, Townsend, Montana.
- Bull, Frieda M., B. S. 1907; M. S. 1909; Instructor in Mathematics, Montana State College, Bozeman, Montana.
- Burke, Edmund, B. S., 1907; Chemist and Meteorologist, Montana Agricultural Experiment Station, Bozeman, Montana.
- Butter, Donald, B. S., 1909; Electrical Engineer, Washington Water Power Co., Post Falls, Idaho.
- Caldwell, Thomas O., B. A. C., 1899; Leasing on Gold Reef and Maginnis Mine, Gilt Edge, Montana.
- Carr, Irene H., B. S., 1911; Mrs. Claude Meserve, Idaho Falls, Idaho.
- Carmichael, Effie, B. S., 1910; Instructor in Home Science in Public Schools, Corning, Iowa.

- Chaffee, Sarah, B. S., 1906; Mrs. Rudolph Beseke, Rathdrum, Idaho.
- Clark, Ben A., B. S., 1911; Farmer, Springdale, Montana.
- Clark, Grace, B. S., 1911; Instructor in Home Science in Girls' Mission School, Old Umtali, Rhodesia, Africa.
- Cockrel, Irvin, B. A. C., 1900; Osteopath Physician, New York City.
- Collins, Walter E., B. S., 1902; Trust Officer State Savings Bank and Practicing Attorney, Butte, Montana.
- Cooke, Amy, B. S., 1908; Mrs. George Ambrose, Mackay, Idaho.
- Cook, George H., B. S., 1912; Farm Superintendent, Gregson, Montana.
- Cowan, Lewis, B. C. E., 1904; Bozeman, Montana.
- Daly, Freeman A., B. S., 1912; R. R. Topographer, Stearns, Montana.
- Davidson, Mary E., B. S., 1910; Student in Deaconess Training School, Chicago, Illinois.
- DeMuth, David R., B. S., 1910; First Assistant Engineer, Hebgen Dam, Norris, Montana.
- DeMuth, Maud S., B. S., 1907; Mrs. W. D. Tallman, Bozeman, Montana.
- Donaldson, Noble C., B. S., 1912; Assistant in Grain Investigation of U. S. Department of Agriculture, Moceasin, Montana.
- Draper, Charles H., B. S., 1912; Editor Carbon County Journal, Red Lodge, Montana.
- Driscoll, William J., B. S., 1908; Civil Engineer, Lawrence, Mass.
- Dusenbury, Inez, B. S., 1912; Rudyard, Montana.
- Edsall, William L., B. S., 1911; Westinghouse Electric Co., Pittsburg, Pennsylvania.
- Edwards, Margaret, B. S., 1912; Instructor in Domestic Science Fergus County High School, Lewistown, Montana.
- Edwards, Timothy, B. S., 1909; Draughtsman N. P. Office, Livingston, Montana.
- Ellis, Edward M., B. S., 1911; General Electric Co., Lynn, Mass.
- Fisher, Charles M., B. S., 1908; Electrical Engineer, Washington Water Power Co., Spokane, Wash.
- Fisher, Helen, B. S., 1910; Bozeman, Montana.
- Flager, Harold J., B. E. E., 1907; Electrical Engineer, Seattle Electric Co., Seattle, Wash.
- Flager, Howard A., B. E. E., 1906; Business, Mount Vernon, Wash.
- Flager, Ruth, B. S., 1910; Mrs. Carl Widener, Bozeman, Montana.
- Flaherty, Charles, B. C. E., 1904; Sacket and Flaherty, Engineers, Livingston, Montana.
- Foster, Florence, B. S., 1896; Mrs. Burton Fleming, Iowa City, Iowa.
- Fox, Hazel, B. S., 1910; Mrs. Byram Mayfield, Enterprise, Oregon.
- Freeman, Beatrice, B. S., 1900; Mrs. Thomas S. Davis, Columbus, Mont.
- Freeman, W. B., B. C. E., 1903; in charge of Irrigation and Drainage for the Government of Siam.
- Froebe, Frank J., B. S., 1911; Local Representative of E. B. Clark Seed Co., Bozeman, Montana.



- Gardiner, Henry C., B. S. A., 1903; Veterinarian and Agriculturist, Anaconda Copper Mining Co., Anaconda, Montana.
- Gottschalk, Carl, B. S., 1909; M. S., 1910; Assistant in Chemistry, Montana State College, Bozeman, Montana.
- Griffith, Warren J., B. E. E., 1907; Clerk, Spokane, Wash.
- Hagerman, Edna, B. S., 1912; Instructor in Home Science, Great Falls, Montana.
- Haines, Will T., B. S., 1911; Instructor in Electrical Engineering and Physics, Montana State College, Bozeman, Montana.
- Ham, Frank W., B. S., 1903; M. S., 1905; Professor of Physics, Montana State College, Bozeman, Montana.
- Hamilton, Everett A., B. S., 1911; Operator Madison River Power Co., Norris, Montana.
- Hartman, June, B. S., 1910; Teacher in the Labarthe Piano School, Chicago, Illinois.
- Hartman, Lois K., B. S., 1907; Instructor in Domestic Science, University of Utah, Salt Lake City, Utah.
- Hartman, Will, B. S., 1908; Crookes and Hartman, Engineers, Livingston, Montana.
- Hawkins, P. H. M. S., 1903; Banker, Absarokee, Montana.
- Henderson, Charles F., B. S., 1910; Westinghouse Electric Co., Pittsburgh, Pa.
- Henderson, Lisle C., B. S., 1909; Missouri River Power Co., Helena, Montana.
- Higgins, Lucille, B. S., 1911; M. S., 1912; Bozeman, Montana.
- Hind, Bert S., B. S., 1909; Superintendent Power Plant, Madison River Power Co., Norris, Montana.
- Hinman, Ruth, B. S., 1912; Teacher in Public School, Ashland, Montana.
- Hodgskiss, John E., B. S., 1912; Graduate Student, Montana State College, Bozeman, Montana.
- Hutton, Fred, B. E. E., 1902; Deceased.
- Jacobs, Lillian, B. S., 1910; Mrs. Arie De Groot, Absarokee, Montana.
- James, John S., B. S., 1909; Assistant Engineer, Valier Irrigation Project, Conrad, Montana.
- Jones, Burle J., B. S., 1904; Manager Orangewood Nursery Co., Phoenix, Arizona.
- Jones, Kyle, B. S., 1912; Graduate Student Montana State College, Bozeman, Montana.
- Jones, Wyatt Wagner, B. S., 1901; M. S., 1902; Plant Pathologist, Mammoth Copper Mining Co., Redding, California.
- Kennedy, Cyril C., B. S., 1910; Power Plant Operator, Madison River Power Co., Norris, Mont.
- Kimpton, Addie, B. S., 1910; Radersburg, Montana.
- King, Lowell, B. S., 1904; Construction Engineer, Electric Railroad, Davenport, Iowa.
- King, Ruby E., B. S., 1909; Mrs. Geo. Hogan, Bozeman, Montana.

- King, Willard V., B. S., 1911; Collaborator U. S. Bureau of Entomology, and Graduate Student at Tulane University, New Orleans, La.
- Kinney, Edward C., B. C. E., 1907; Chief of Construction United States Reclamation Service, Ganado, Arizona.
- Kirk, Grace, B. S., 1911; Instructor in Domestic Science, Sweetgrass County High School, Big Timber, Montana.
- Kirk, Mary E., B. S., 1906; Mrs. Ermine Potter, Corvallis, Oregon.
- Kirscher, W. Guy, B. S., 1909; County Surveyor, Broadwater Co., Townsend, Mont.
- Koch, Elers, B. S., 1901; Supervisor Forest Service, Missoula, Montana.
- Kremer, William J., B. S., 1910; Hydraulic Engineer, Madison Land and Irrigation Co., Bozeman, Montana.
- Lamme, Maurice A., B. S., 1903; Director of Geology and Mineralogy, Government University, Montevideo, Uruguay, S. A.
- Lannin, Earl A., B. S., 1912; Westinghouse Electric Co., Pittsburg, Pa.
- Lewis, Edna, B. S., 1903; Instructor in Mathematics, Gallatin County High School, and Member of County Board of Examiners, Bozeman, Montana.
- Livingston, Walter, B. S., 1910; Civil Engineer, Bozeman, Montana.
- Locke, Jerome G., B. C. E., 1908; C. E., 1910; Surveyor General of Montana, Helena, Montana.
- Lorentz, Floyd, S. B. E. E., 1907; E. E., 1910; Electrical Engineer, Keating Gold Mining Co., Radersburg, Montana.
- Luther, J. Glen, B. S., 1912; Electrical Engineer Conray Placer Mining Co., Ruby, Mont.
- Maynard, Edna, B. S., 1900; M. S., 1903; Mrs. G. T. Morris, Bozeman, Montana.
- McCraw, John L., B. S., 1912; Deceased.
- Metheny, Blanche, B. S., 1911; Supervisor of Domestic Art, Bozeman City Schools, Bozeman, Mont.
- Millegan, Guy J., B. S., 1912; Homesteader and Farmer, Millegan, Montana.
- Monforton, Zoe, B. S., 1901; Mrs. Dr. H. C. Patterson, Los Angeles, Calif.
- Moore, Ellie J., B. S., 1901; Farmer, Bozeman, Montana.
- Morgan, George W., B. S., 1912; Scientific Assistant, Office Forage Crops Investigation, Bureau of Plant Industry, Department of Agriculture, Washington, D. C.
- Morgan, Joseph D., B. S., 1912; Graduate Student Montana State College and Real Estate Business, Bozeman, Montana.
- Morgan, Oliver P., B. S., 1896; Deceased.
- Morris, Elwood, B. S., 1909; Assistant Botanist and Bacteriologist, Montana Agricultural Experiment Station, Bozeman, Montana.
- Morris, Garfield T., B. C. E., 1903; Civil Engineer, Bozeman, Montana.
- Mountjoy, Agnes, B. S., 1907; Homesteader, Cardwell, Montana.
- Mountjoy, Irvin, B. E. E., 1908; Homesteader, Cardwell, Montana.
- Nash, Lewis, B. S., 1904; Farmer, Hardin, Montana.

- Noble, Erma, B. S., 1909; M. S., 1910; Teacher, Bozeman Public Schools, Bozeman, Montana.
- Osborne, Belle, B. S., 1907; Mrs. D. E. Fish, Adel, Iowa.
- Pease, Jay L., B. C. E., 1907; Farmer, Bozeman, Mont.
- Peck, Harry L., B. S., 1911; Westinghouse Electric Co., Wilksburg, Pa.
- Penwell, Clyde C., B. S., 1906; B. E. E., 1907; Belgrade, Mont.
- Penwell, Clyde W., B. E. E., 1909; Manager Independent Telephone Co., Larned, Kas.
- Peters, Orville S., B. S., 1909; E. E., 1912; Assistant Physicist, Bureau of Standards, Washington, D. C.
- Peterson, James A., B. S., 1909; Assistant to Sunday Editor, St. Paul Dispatch and Pioneer Press, and Law Student, University of Minnesota, St. Paul.
- Philpott, June, B. S., 1911; M. S., 1912; Corvallis, Oregon.
- Piedalue, Irene, B. S., 1911; Bozeman, Montana.
- Piedalue, Laura, B. S., 1912; Instructor in Sewing, Helena High School, Helena, Montana.
- Pool, Louis K., B. S., 1910; City Engineer, Polson, Montana.
- Potter, Ermine L., B. S., 1906; Professor Animal Husbandry, Oregon Agricultural College, Corvallis, Oregon.
- Quaw, Eugene C., B. S., 1911; Playwright, Bozeman, Montana.
- Quaw, Lucille, B. S., 1903; Instructor in Home Science in Public Schools, Orting, Wash.
- Quaw, Mignon, B. S., 1902; Instructor Gallatin County High School, Bozeman, Montana.
- Quaw, Thomas B., B. S., 1907; Principal of Joliet Public School, Joliet, Montana.
- Reese, Herbert J., B. S., 1904; Long Beach, California.
- Robinson, J. W., B. S., 1908; Salesman, Benepe-Burgland Grain Co., Manhattan, Montana.
- Sacket, Charles T., B. C. E., 1904; C. E., 1907; Consulting Civil Engineer, Livingston, Montana.
- Sales, Reno H., B. S., 1898; Geologist, Anaconda Copper Co., Butte, Mont.
- Schabarker, W. W., B. M. E., 1902; Night Foreman, Shops Milwaukee R. R., Milwaukee, Wis.
- Schmidt, F. W., B. S., 1903; Superintendent Cyanide Plant, Xiririca, San Paule, Brazil, S. A.
- Shaw, W. T., B. S., 1896; Unknown.
- Shovell, William L., B. S., 1912; Horticultural Expert, Bitter Root Irrigation Co., Hamilton, Montana.
- Sloan, J. Harvey, B. C. E., 1903; In Public Service Commission, Madison, Wisconsin.
- Sloan, W. F., B. E. E., 1903; Public Commissioner, Madison, Wisconsin.
- Sloan, William Glenn, B. S., 1910; Government Drainage Engineer, Boise, Idaho.
- Snyder, Leta, B. S., 1911; Teacher, High School, Genesee, Idaho.

- Spain, Marvin, B. S., 1911; In charge of Grain Testing, Montana Experiment Station, Bozeman, Montana.
- Spain, Whitfield, B. S., 1909; Manager of ranch, Belgrade, Montana.
- Spragg, Frank A., B. S. A., 1902; Plant Breeder of Farm Crops for the Michigan Experiment Station, Lansing, Mich.
- Stafford, Lucy B., B. S., 1896; Mrs. Wm. Peck, Pony, Mont.
- Taylor, John C., B. S., 1912; Manager livestock ranch, Lloyd, Montana.
- Tavener, Frank C., B. C. E., 1903; Construction Engineer, Montpelier, Idaho.
- Thompson, Homer C., B. S., 1902; Principal of High and Grade Schools, Three Forks, Mont.
- Thorpe, Mabel A., B. S., 1907; Mrs. J. A. Thaler, Bozeman, Mont.
- Thorpe, Elizabeth, B. S., 1907; Teacher in Public Schools, Ogden, Utah.
- Tracy, Edna B., B. S., 1908; Teacher in High School, Belgrade, Montana.
- Tremper, Wm. G., B. S., 1911; U. S. Deputy Surveyor, Helena, Montana.
- Vreeland, Edna, B. S., 1909; Shay's Cafeteria, Salt Lake City, Utah. Forks, Montana.
- Wade, Arthur M., B. S., 1911; Engineer, C. M. & St. P. R. R., Three Walechli, Fred E., B. S., 1910; Mechanical Engineer, Construction Work, Kalispell, Montana.
- Widener, Carl C., B. S., 1908; City Engineer, Bozeman, Montana.
- Williams, Frank B., B. M. E., 1899; Bozeman, Montana.
- Williams, Lee, B. E. E., 1902; County Surveyor, Powell County, and City Engineer, Deer Lodge, Mont.
- Williams, Roy B., B. S., 1911; U. S. Reclamation Service, St. Ignatius, Montana.
- Williams, Sidney A., B. S., 1911; Westinghouse Electric Co., Wilkesburg, Pa.
- Wilson, Elva A., B. S., 1909; Teacher, Public Schools, Bozeman, Mont.
- Wolpert, Harold E., B. S., 1912; Working in Smelter, Mullen, Idaho.
- Wylie, Mary, B. S., 1910; Homesteader, Portage, Montana.

#### PHARMACY SCHOOL ALUMNI.

- Allen Edgar Warren, Ph. C., 1910; Red Lodge Drug Co., Proprietor.
- Conrad, Blanche, Ph. C., 1910; Gallatin Drug Co., Bozeman, Mont.
- Cox, Harvey H., Ph. C., 1910; Gallatin Drug Co., Bozeman, Mont.
- Crosby Spencer J., Ph. C., 1911; Nelson Drug Co., Big Timber, Mont.
- Drinville, James, Ph. C., 1910; Fuller Drug Co., Havre, Mont.
- Mitchell, Paul L., Ph. C., 1909; Foster Drug Co., Miles City, Mont.
- McCarthy, Ray., Ph. C., 1911; Mrs. E. H. Williams, Radersburg, Mont.
- Morris, Abbie F., Ph. C., 1911; Virginia City, Mont.
- Burfiend, Henry C., Ph. C., 1912; Proprietor City Drug Store, Dillon, Montana.
- Valentine, Charles P., Ph. C., 1910; Lapeyre Bros., Great Falls, Mont.
- Young, Earl, Ph. C., 1910; J. A. Turner Drug Store, Huntley, Mont.

## SCHOOL OF MUSIC GRADUATES.

Alward, Coda, Piano, 1908.....	Polson, Mont.
Bancroft, Alma J., Piano, 1911, Teacher.....	Bozeman, Mont.
Benge, Faith, Piano, 1910.....	Winterset, Iowa.
Brown, Edith, Piano, 1906, Mrs. John Milloy.....	Regina, Canada.
Featherston, Ellis, Piano, 1907, Music Supervisor.....	Mattewan, N. Y.
Freeman, Lorraine, Piano, 1906, Teacher.....	Bozeman, Mont.
Griffin, Grace, Piano, 1907, Mrs. W. C. Blythe.....	Whittier, Cal.
Hartman, Flora, Piano, 1907, Teacher.....	Bozeman, Mont.
Hartman, June, Piano, 1910, Teacher and Student.....	Chicago, Ill.
Hollier, Georgia, Piano, 19122, Student.....	Bozeman, Mont.
Lovelace, Amy, Vocal, 1908, Teacher.....	Bozeman, Mont.
Maynard, Frances, Piano, 1909, Mrs. Ed. Howard.....	Bozeman, Mont.
Piedalue, Alice, Piano, 1908; Mrs. C. W. Hancock.....	Lewistown, Mont.
Stanton, Grace, Piano, 1901; Mrs. W. B. Walker.....	Missoula, Mont.
Sales, Zada, Piano, 1912, Student.....	Bozeman, Mont.
Schumacher, Hettie, Piano, 1912, Ttacher.....	Bozeman, Mont.
Waters, Mary, Piano, 1902; Mrs. H. L. Houston, Teacher....	Helena, Mont.
Widener, Carl, Vocal, 1908; City Engineer.....	Bozeman, Mont.
Work, Vida, Piano, 1909, Mrs. Ray Holloway.....	Bozeman, Mont.



# Degrees Granted June, 1912

## ELECTRICAL ENGINEER.

Peters, Orville S. .... Electrical Engineer

## MASTER OF SCIENCE.

Higgins, Lucille ..... Mathematics-Physics

Philpott, June ..... Mathematics-Physics

## BACHELOR OF SCIENCE.

Blessing, John ..... Horticulture

Baker, Florence ..... History-Literature

Cook, George H. .... Horticulture

Donaldson, Noble C. .... Agronomy

Daley, Freeman A. .... Civil Engineering

Draper, Charles H. .... History-Literature

Dusenbery, Inez ..... History-Literature

Edwards, Margaret ..... Home Economics

Hagerman, Edna ..... Home Economics

Hinman, Ruth ..... History-Literature

Hodgskiss, John E. .... Agronomy

Jones, Kyle ..... History-Literature

Lannin, Earl ..... Electrical Engineering

Luther, J. Glenn ..... Electrical Engineering

McCraw, John L. .... Civil Engineering

Millegan, Guy J. .... Agronomy

Morgan, George W. .... Agronomy

Morgan, Joseph D. .... Biology

Piedalue, Laura ..... Home Economics

Shovell, William L. .... Horticulture

Taylor, John C. .... Agronomy

Wolpert, Harold E. .... Civil Engineering

## PHARMACEUTICAL CHEMIST.

Burfiend, Henry C. .... Dillon

## MUSIC.

### DIPLOMA.

Hollier, Georgia ..... Bozeman

Sales, Zada ..... Bozeman

Schumacher, Hettie ..... Bozeman

# Names of Students 1912-13

## POST GRADUATES.

Dockstader, E. A.....	Mathematics .....	Bozeman
Hodgskiss, John E.....	Agriculture.....	Choteau
Jones, Kyle.....	History-Literature .....	Bynum
Morgan, Joseph.....	Secretarial .....	Bozeman
Quaw, Eugene.....	Secretarial .....	Bozeman

## SENIORS.

Alderson, Myrtle.....	History-Literature.....	Marysville
Bole, Margaret .....	Mathematics-Physics .....	Bozeman
Brook, Thomas B.....	Mechanical Engineering.....	Bozeman
Brabrook, Ralph.....	Civil Engineering.....	Indianapolis, Ind.
Blinn, George.....	Agriculture .....	Butte
Clark, Olive L.....	Home Economics.....	Bozeman
Douglas, Stanley.....	Electrical Engineering.....	Bozeman
Dawes, Rhoda.....	Home Economics.....	Bozeman
Gordon, Fred E.....	Agriculture .....	Bozeman
Hartman, Brook.....	Mathematics-Physics.....	Bozeman
Hartman, Ruth.....	Home Economics.....	Bozeman
Hansen, Charles L.....	Agriculture .....	Dillon
Leinard, Ford.....	Agriculture .....	Bryan, Ohio
MacKay, Warren C.....	Electrical Engineering.....	Anaconda
Sacket, Nathalie.....	Civil Engineering.....	Bozeman
Soper, Joseph R.....	Agriculture .....	Bozeman
Smith, M. Alda.....	Home Economics.....	Dillon
Seamans, Arthur E.....	Agriculture .....	Wauwatosa, Wis.
Truman, Joseph K.....	Electrical Engineering.....	Bozeman
Wharton, John C.....	Agriculture .....	Butte
Willson, Walter G.....	Electrical Engineering.....	Bozeman
Williams, Elmer J.....	Electrical Engineering.....	Cascade
Wiley, Leroy D.....	Agriculture .....	Briston
Wylie, Lawrence.....	Electrical Engineering.....	Bozeman

## JUNIORS.

Atkins, Willard E.....	History-Literature.....	Chicago, Ill.
Buckley, Thomas W.....	Civil Engineering.....	Manhattan
Clark, George R.....	Agriculture.....	Chinook
Cullum, Georgia.....	Home Economics .....	Helena
Dissly, Frederick L.....	Agriculture.....	Sugar Creek, Ohio
Everett, Inez.....	Home Economics.....	Big Timber
Eckels, Mildred.....	Home Economics.....	Forsyth
Flanders, Clara.....	Home Economics.....	Bozeman
Harmon, Ella M.....	Home Economics.....	Helena
Heighton, Pearl M.....	Home Economics .....	Bozeman
Hodgskiss, Wm. L.....	Agriculture .....	Choteau

Kenck, Max W.....	Electrical Engineering.....	Butte
Kiefer, James .....	Mathematics-Physics .....	Bozeman
Martin, Claud A.....	Civil Engineering.....	Stockett
Millegan, Homer D.....	Agriculture .....	Millegan
Roecher, Rausie.....	Home Economics .....	Bozeman
Spain, Roy.....	Agriculture .....	Bozeman
Solberg, Selmer H.....	Electrical Engineering.....	Big Timber
Switzer, Madge.....	Home Economics .....	Bozeman
Truitt, Charles A.....	Civil Engineering.....	Bozeman
Vestal, Wm. B.....	Civil Engineering.....	Indianapolis, Ind.
Valleau, Vie H.....	Art .....	Porcupine
Whitworth, Wm. J.....	Electrical Engineering.....	Deer Lodge
Webster, Alden.....	Electrical Engineering.....	Bozeman

## SOPHOMORES.

Abell, Tracy H.....	Agriculture .....	Bozeman
Breneman, Edith M.....	Secretarial .....	Bozeman
Batch, Otto C.....	Agriculture .....	Helena
Border, J. Ernest .....	Agriculture .....	Bozeman
Burket, Alonzo.....	Chemistry .....	Bozeman
Coffey, Hazel.....	Home Economics .....	Bozeman
Davidson, Lyndall P.....	Chemistry .....	Bozeman
Dahl, Hilmer L.....	Mechanical Engineering.....	Belt
Dahling, Louis.....	Secretarial .....	Bozeman
Eberle, Alfred.....	Agriculture .....	Butte
Elliott, Archie.....	Agriculture .....	Great Falls
Fiske, John .....	Electrical Engineering.....	Helena
Fitch, Meryl A.....	History-Literature .....	Kalispell
Fowler, Viola .....	Secretarial .....	Bozeman
Grimes, Walter W.....	Agriculture .....	Bozeman
Gray, Florence.....	Mathematics-Physics .....	Bozeman
Gummer, Harry A.....	Agriculture .....	Frazee, Minn.
Gray, Chas. W.....	Agriculture.....	Great Falls
Gray, Mary B.....	History-Literature.....	Great Falls
Goodson, Anna .....	Home Economics .....	Livingston
Haegele, Rowland.....	Agriculture .....	Helena
Hartman, Leah.....	Home Economics .....	Bozeman
Hopkins, Hazel.....	Secretarial .....	Anaconda
Hollier, Georgia.....	Secretarial .....	Bozeman
Jones, Ray S.....	Chemistry .....	Livingston
Jacobs, Edward B.....	Electrical Engineering.....	Delta, Colo.
Kolb, Percy F.....	Agriculture .....	Billings
Kelly, Robert T.....	Civil Engineering .....	Anaconda
Kennard, Eveleen M.....	Home Economics .....	Kinsey
Kelly, Martin E.....	Civil Engineering .....	Anaconda
Linfield, Alfred.....	History-Literature .....	Bozeman
Larson, Elmer N.....	Civil Engineering.....	Livingston

Lott, Mortimer J.....	Agriculture .....	Twin Bridges
Maddox, W. E.....	Agriculture .....	Gove, Kansas
Morgan, Carl F.....	Civil Engineering.....	Joliet
Myers, Ada Mae.....	Home Economics .....	Billings
Moore, Inez E.....	Secretarial .....	Bozeman
Martin, Flossie .....	Secretarial .....	Humansville, Mo.
Malsor, Roy E.....	Civil Engineering .....	Anaconda
Miller, Archie.....	Secretarial .....	Hopkins, Minn.
Miewald, Mabel.....	Home Economics .....	Chinook
Noble, Edward G.....	Agriculture .....	White Hall
Olsen, Ella K.....	Secretarial .....	Silver Bow
Piedaue, Aimee M.....	Secretarial .....	Bozeman
Poole, Florence E.....	Home Economics.....	Townsend
Potter, John V.....	Electrical Eng.....	White Sulphur Spgs.
Pettigrew, Leslie.....	Electrical Engineering.....	Great Falls
Powers, Walter G.....	Mechanical Engineering.....	Great Falls
Papke, Wm. A.....	Civil Engineering.....	Bozeman
Roosevelt, George A.....	Agriculture .....	Ackley, Iowa
Sultzzer, Willa.....	History-Literature .....	Butte
Swain, Albert F.....	Biology .....	Willis
Steel, W. Hamilton.....	Electrical Engineering...	Great Falls
Sutherland, Edward L.....	Civil Engineering, Central City, S.D.	
Schumacher, Frederick W.....	Agriculture .....	Argenta
Talcott, Kenyon I.....	Chemistry .....	Livingston
Thompson, Alfred .....	Chemistry .....	Bozeman
Taylor, Emma .....	Home Economics.....	Bozeman
Tait, John B.....	Agriculture .....	Anaconda
Woodin, Lucy .....	Home Economics .....	Bozeman
Wilcomb, Max J.....	Civil Engineering.....	Twin Bridges
Wilson, Kathleen .....	Home Economics .....	Bozeman
Wood, Elwin G.....	Agriculture .....	Big Fork
Wood, Christiana .....	Home Economics .....	Big Fork
Whipple, Charles A.....	Agriculture .....	Helena

## FRESHMEN.

Allen, Mollie J.....	Home Economics.....	Butte
Alexander, Maud .....	Secretarial .....	Bozeman
Borthwick, Alberta .....	Home Economics .....	Hamar, N. D.
Baxter, J. Anson.....	Electrical Engineering.....	Dillon
Baril, Myron .....	Mechanical Engineering.....	Sheridan
Berg, Helmar .....	Mechanical Engineering.....	Lennepe
Boyle, Evelyn .....	Art .....	Havre
Bowlen, Raymond .....	Agriculture .....	Red Lodge
Chestnut, Lulu M.....	Home Economics .....	Havre
Cotner, Victor.....	Civil Engineering.....	Lovell, Wyo.
Connor, Vivian .....	Agriculture .....	Choteau
Cook, Donald .....	Electrical Eng.....	White Sulphur Spgs.

Connor, Alden .....	Mechanical Engineering.....	Choteau
Clarkson, Robert .....	Agriculture .....	Chinook
Cannon, Harvena .....	History-Literature.....	Kalispell
Christie, Alex .....	Agriculture .....	Butte
Carr, Myron .....	Agriculture .....	Bozeman
Cooley, Esther B.....	Biology .....	Bozeman
Cassidy, Frank J.....	Chemistry .....	Winston
Driscoll, Thos. ....	Electrical Engineering.....	Butte
Ferguson, Veda .....	Home Economics .....	Bozeman
Fenner, Willie Louise.....	History-Literature .....	Butte
Fletcher, Marion E.....	Home Economics .....	Bozeman
Ford, Arthur .....	Mechanical Engineering.....	Helena
Hinton, Hallie .....	Home Economics.....	Bozeman
Higgins, Patti .....	Home Economics.....	Bozeman
Heageny, Wm. F.....	Agriculture .....	Bozeman
Hibbard, Harrell H.....	Agriculture .....	Helena
Hudson, Herbert .....	Civil Engineering.....	Sheridan
Jackson, Joel.....	Agriculture .....	Harrison
Kountz, Josephine .....	Home Economics.....	Bozeman
Kaylor, J. Stanley.....	Mechanical Engineering.....	Bozeman
Kinsella, Olive A.....	History-Literature .....	Bozeman
Luther, Harold W.....	Electrical Engineering.....	Choteau
Larson, Mary E.....	Home Economics.....	Boulder
Lescher, Taylor .....	Electrical Engineering.....	Great Falls
Lessel, Erma .....	Home Economics .....	Butte
Milburn, George R.....	Civil Engineering.....	Butte
Miller, Oscar .....	Electrical Engineering.....	Bozeman
Mills, Jessie Gwendolyn.....	Home Economics .....	Helena
McMahon, Blanche.....	Secretarial .....	Bozeman
McCune, Alice .....	Home Economics .....	Stevensville
McGurk, Mary .....	Home Economics .....	Philipsburg
McRoberts, Edith .....	Home Economics .....	Bozeman
Miewald, Ethel .....	Home Economics .....	Chinook
Nordquist, Clark .....	Electrical Engineering.....	Bozeman
Oliver, Grace E.....	Home Economics .....	Billings
O'Connor, William.....	Agriculture .....	Red Lodge
Osenberg, Albert .....	Agriculture .....	Butte
Powers, Anna .....	Home Economics.....	Fort Benton
Purdy, Ray A.....	Secretarial .....	Brainerd, Minn.
Riddell, Marsa .....	Home Economics .....	Helena
Ross, William D.....	Agriculture .....	Dillon
Slavens, Opal V.....	History-Literature .....	Bozeman
Sweat, Ruth .....	Home Economics .....	Great Falls
Schattenberg, Adolph .....	Agriculture .....	Boerne, Texas
Stanley, Amelia .....	Home Economics .....	Great Falls
Steel, David .....	Civil Engineering.....	Great Falls



Seamans, Howard L.....	Biology .....	Wauwatosa, Wis.
Selin, Olive .....	Home Economics .....	Dutton
Sutton, Barbara .....	Home Economics .....	Bozeman
Tuttle, Lulu O.....	Home Economics .....	Boulder
Tintinger, Lyle.....	Chemistry .....	Billings
Tubbs, Palmer H.....	Civil Engineering.....	Elkhorn, Wis.
Ulmer, Alice .....	Secretarial .....	Belgrade
Wallace, Leo .....	Agriculture .....	Musselshell
Widener, Harold T.....	Agriculture .....	Bozeman
Walker, Cecil .....	Home Economics.....	Bozeman
Wight, Florence A. ....	Home Economics.....	White Sul. Spgs.
Wilson, Glen I.....	Secretarial .....	Bozeman

**SCHOOL OF PHARMACY.****FIRST YEAR.**

Vicars, William.....	Bozeman
Grant, H. P. ....	Wilmot, Ohio

**SECOND YEAR.**

Fischl, Louis J.....	Helena
Gosman, George M.....	Dillon
Lapeyre, Robert .....	Great Falls
Stieb, Clyde W.....	Hamilton
Solberg, Harold .....	Big Timber

**THIRD YEAR.**

Converse, Earl W.....	Anaconda
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**PREPARATORY SCHOOL.****FIRST YEAR.**

Bernier, Dan M.....	Mechanic Arts.....	Hogan
Badgley, Jerome .....	Mechanic Arts.....	Belgrade
Belden, Harold .....	Mechanic Arts .....	Utica
Cole, Garnet .....	Mechanic Arts .....	Helena
Conrow, Darl .....	Mechanic Arts.....	Belgrade
Ingram, Eunice .....	Home Economics.....	Bozeman
Jahn, Albert .....	Mechanic Arts.....	Winona, Minn.
Murray, Henry .....	Mechanic Arts.....	Hobson
Murray, Joseph .....	Mechanic Arts.....	Hobson
Nelson, Oscar .....	Mechanic Arts.....	Helmville
Patterson, Dorothy .....	Scientific .....	Radersburg
Rand, Ralph .....	Mechanic Arts.....	Butte
Wilson, Bryan O.....	Scientific .....	Pray

**SECOND YEAR.**

Beach, Ben.....	Mechanic Arts.....	Mitchell
Callaway, Mariam.....	Home Economics.....	Virginia City
Erwin, Kent.....	Mechanic Arts.....	Bozeman
Harris, Earl.....	Mechanic Arts.....	East Helena
Henry, Louis.....	Mechanic Arts.....	Somers

## MONTANA STATE COLLEGE

Henry, Angeline.....	Home Economics.....	Somers
Johns, Opal.....	Home Economics.....	Bozeman
Porter, William.....	Mechanic Arts.....	Roundup
Stone, Louise.....	Home Economics.....	Belgrade
Stone, Franklin.....	Mechanic Arts.....	Belgrade
Stone, Parker.....	Mechanic Arts.....	Belgrade

## THIRD YEAR.

Beerstecher, Ada.....	Home Economics.....	Belgrade
Cowgill, Geyer.....	Mechanic Arts.....	Choteau
Fletcher, Ruth.....	Scientific.....	White Sulphur Springs
Ford, Albert D.....	Mechanic Arts.....	Bozeman
Flint, Nelson.....	Mechanic Arts.....	Bozeman
Finlay, William.....	Mechanic Arts.....	Bozeman
Gerber, Elsie.....	Home Economics.....	Sand Coulee
George, Raymond.....	Scientific.....	Billings
Jacques, Henry F.....	Mechanic Arts.....	Butte
Morarity, Sidney.....	Scientific.....	Toston
McMillan, Anna K.....	Home Economics.....	Lewistown
McHugh, Violet.....	Home Economics.....	Lewistown
McVay, Pauline.....	Home Economics.....	Belgrade
Nelson, Albert.....	Mechanic Arts.....	Helmville
Pink, William.....	Mechanic Arts.....	Silver Star
Pope, Alger.....	Mechanic Arts.....	County Line, Ark.
Pierce, Thomas.....	Scientific.....	Bozeman
Schowe, William.....	Scientific.....	Sheridan

## FOURTH YEAR.

Bell, M. V.....	Scientific.....	Helena
Cook, Chas. W.....	Mechanic Arts.....	Roundup
Dissly, William.....	Scientific.....	Sugar Creek, Ohio
Elliott, Mae.....	Home Economics.....	Clara
Kammerer, Harry.....	Mechanic Arts.....	Bozeman
Lindstrand, Florence.....	Home Economics.....	Elso
McDougall, Allan.....	Scientific.....	Butte
Monson, William.....	Mechanic Arts.....	Ovando
Murphy, J. Arthur.....	Mechanic Arts.....	Butte
Oyler, Coleman.....	Mechanic Arts.....	Butte
Riordan, Emmet.....	Scientific.....	Waterbury, Conn.
Thompson, W. Talbot.....	Scientific.....	Bozeman
Undem, Louis.....	Scientific.....	Chicago, Ill.
Wellman, Bingham.....	Scientific.....	Augusta
White, Silvanus.....	Mechanic Arts.....	Augusta

## IRREGULAR.

Lanz, Nathalie.....	.....	Bozeman
Schoch, Nicholas.....	.....	Geneva, Switzerland
Warren, Floyd.....	.....	Hardin

## SCHOOL OF AGRICULTURE.

## FIRST YEAR.

Bennett, W. O.....	Livingston
Berube, Ray .....	Augusta
Blocher, Ralph H.....	Billings
Campbell, Arthur B.....	Anaconda
Carter, Howard .....	Livingston
Crawford, Herbert.....	Billings
Courtney, Lyle .....	Belgrade
Dorrance, Frank.....	Lewistown
Doran, James J.....	Butte
Dahlstrom, Victor .....	Conrad
Dehler, August .....	Helena
Davidson, Roscoe .....	Cameron
Davidson, Edgar .....	Cameron
Fluhr, William H.....	Helena
Fraser, Chester.....	Grey Cliff
Fowler, Carl H.....	Concord
Ireland, Henry B.....	Augusta
Johns, Earl.....	Bozeman
Johnson, Eben.....	Sweet Grass
Knudson, Adolph .....	Shawmut
Krumm, James.....	Columbus, Ohio
Lay, Harvey .....	Trident
Lupfer, Joseph F.....	Denver, Colo.
Murray, John.....	Hobson
McMahon, Ernest .....	Bozeman
McLean, Bruce .....	Miles City
Nelson, Samuel R.....	Havre
Nicholson, John .....	Bozeman
Pope, Clarence.....	Miles City
Rowland, Arthur S.....	Bynum
Starz, Oscar W.....	Helena
Sweeney, William .....	Kendall
Selleck, Thomas J.....	Roscoe
Storey, Luther .....	Cameron
Schanck, Milo.....	Roberts
Turban, C. A.....	Chicago, Ill.
Tintinger, Lester E.....	Cascade
Weaver, Chester.....	Miles City
Weaver, James H.....	Bearmouth
Wilcox, Roe S. ....	Dupuyer
Yegen,, Dave.....	Billings
Zook, Fritz.....	Miles City

## SECOND YEAR.

Allphin, Fred .....	Wilsall
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Ashby, H. N.....	Bozeman
Carpenter, Alvin P.....	Clyde Park
Fry, Louis E.....	Elmo
Higgins, Ross .....	Dorsey
Lindsay, William .....	Butte
Timmons, John.....	Havre

## THIRD YEAR.

Degenhart, Christopher.....	Philipsburg
DeAtley, Gail.....	Clyde Park
Haight, Howard.....	Great Falls
Peterson, Frank T.....	Absarokee

## ONE YEAR HOME ECONOMICS

Brooks, Lucy .....	Bozeman
Cline, Mildred .....	Bozeman
Cline, Marie D.....	Bozeman
Delaney, Sue.....	Bristol, Tenn.
Gorman, May .....	Maiden
Huseth, Olive.....	Great Falls
Huseth, Blanche.....	Great Falls
Koch, Francisca.....	Bozeman
Kinsey, Clara.....	Halfway, Oregon
Kerr, Etta.....	Butte
Nelson, Ragnhild.....	Belt
Rubottom, Anna L.....	Great Falls
Sweeney, Anna.....	Hilger
Settle, Ruby.....	Bozeman
Stout, Wanita.....	Bozeman
Smith, Inez .....	Bozeman
Sheldon, Helen .....	Belt
Tresch, Marie .....	Glengarry
Turner, Elsie.....	Belt

## MUSIC STUDENTS.

Acola, Estella .....	Piano .....	Bozeman
Accola, Grace .....	Piano .....	Bozeman
Alderson, Myrtle .....	Piano .....	Marysville
Alexander, Maud .....	Piano, Harmony, History.....	Bozeman
Atkins, Willard .....	Voice .....	Chicago, Ill.
Atwood, J. M. ....	Violin .....	Bozeman
Beck, Elsie .....	Piano .....	Bozeman
Beerstecher, Ada .....	Piano .....	Belgrade
Bole, Margaret .....	Piano .....	Bozeman
Brown, Mrs. Fred.....	Piano .....	Bozeman
Border, Lela .....	Piano .....	Bozeman
Brook, John .....	Violin .....	Bozeman
Borthwick, Alberta .....	Voice, Harmony.....	Hamar, N. D.

Brandenburg, Jonas .....	Violin .....	Bozeman
Bradford, Lillian .....	Voice .....	Bozeman
Blackenship, J. ....	Violin .....	Bozeman
Cannon, Harvena .....	Piano .....	Kalispell
Clark, Olive .....	Voice .....	Bozeman
Clark, Louise .....	Piano .....	Bozeman
Clarkson, George .....	Violin .....	Bozeman
Cullum, Georgia .....	Voice .....	Helena
Cunningham, Myrna .....	Piano .....	Bozeman
Davidson, Paul .....	Violin .....	Bozeman
Dawes, Bessie .....	Piano .....	Bozeman
Dawes, Rhoda .....	Piano .....	Bozeman
Eckels, Mildred .....	Voice .....	Forsyth
Elliott, Mae .....	Piano, Harmony .....	Clara
Erwin, Mae .....	Piano .....	Bozeman
Everett, Inez .....	Voice .....	Big Timber
Fenner, Willie Louise .....	Piano .....	Butte
Flanders, Clara .....	Voice .....	Bozeman
Fletcher, Ruth .....	Piano .....	White Sulphur Springs
Fransham, Edna .....	Piano .....	Bozeman
Gerber, Elsie .....	Piano .....	Sand Coulee
Gray, David .....	Violin .....	Bozeman
Glisson, Mrs. C. O. ....	Piano-History .....	Bozeman
Griffith, Gladys .....	Piano-Harmony-History .....	Bozeman
Griffin, Juanita .....	Piano .....	Bozeman
Harmon, Ella .....	Voice .....	Helena
Harris, Vera .....	Piano .....	Bozeman
Hartman, Brooke .....	Piano .....	Bozeman
Hartman, Leah .....	Piano, Harmony .....	Bozeman
Hartman, Ruth .....	Piano, History .....	Bozeman
Heighton, Pearl .....	Piano .....	Bozeman
Henry, Roberta A. ....	Piano, History .....	Bozeman
Holderby, Josie .....	Piano .....	Bozeman
Hollier, Georgia .....	Piano .....	Bozeman
Hollier, Trena .....	Piano .....	Bozeman
Hollier, Myrtle .....	Piano .....	Bozeman
Hopkins, Hazel .....	Piano .....	Anaconda
Hutchinson, Helen .....	Piano .....	Bozeman
Huseth, Blanche .....	Piano .....	Great Falls
Huseth, Olive .....	Piano .....	Great Falls
Hutton, Donald .....	Violin .....	Jeffers
Jones, Kyle .....	Violin .....	Dupuyer
Kammerer, Sophia .....	Piano-Harmony .....	Bozeman
Kinsey, Clara .....	Piano .....	Glendive
Kerr, Etta .....	Piano .....	Butte



Kennard, Eveleen .....	Piano .....	Miles City
Kirschner, Hortense .....	Piano-Harmony.....	Bozeman
Kirk, Christine .....	Piano .....	Bozeman
Koch, Frankie .....	Piano .....	Bozeman
La Boute, Walter .....	Violin .....	Bozeman
Lessel, Erma .....	Piano .....	Butte
Linfield, Azalia .....	Piano .....	Bozeman
Linfield, Leila .....	Piano .....	Bozeman
Lyons, Mabel .....	Piano .....	Bozeman
Lyons, Hazel .....	Violin .....	Bozeman
Martin, Atha .....	Piano .....	Bozeman
Milligan, Homer .....	Voice .....	Milligan
Miller, Robert .....	Violin .....	Bozeman
Muse, George .....	Violin .....	Bozeman
McDonnell, Aline .....	Piano .....	Bozeman
Martin, Flossie .....	Piano .....	Humansville, Mo.
McMahon, Blanche .....	Piano .....	Bozeman
McVay, Pauline .....	Piano .....	Belgrade
McNeeley, Blanche .....	Voice .....	Bozeman
Nelson, Melba .....	Piano .....	Bozeman
Nichols, Marjorie.....	Piano .....	Bozeman
Norton, Frances .....	Piano .....	Bozeman
Orvis, Worth .....	Piano-Harmony .....	Salesville
O'Donnell, Kathleen .....	Violin .....	Bozeman
Perks, Alejs .....	Piano .....	Manhattan
Powers, Annie .....	Piano, Voice .....	Fort Benton
Pease, Edith .....	Piano .....	Bozeman
Quaw, Eugene .....	Piano .....	Bozeman
Roecher, Rausie .....	Piano .....	Bozeman
Rouse, Ruby .....	Piano .....	Bozeman
Rubottom, Anna .....	Piano .....	Great Falls
Settle, Ruby .....	Piano .....	Bozeman
Sheldon, Helen .....	Piano .....	Belt
Smith, Alda .....	Piano .....	Bozeman
Simpson, Kate .....	Harmony .....	Bozeman
Story, Mayo .....	Piano .....	Bozeman
Smith, H. E. .....	Violin .....	Bozeman
Switzer, Madge .....	Piano .....	Bozeman
Spain, Roy .....	Voice .....	Bozeman
Terrell, Irene .....	Piano .....	Wibaux
Terrell, Violet .....	Piano .....	Wibaux
Thorpe, Florence .....	Piano, Harmony, History...	Bozeman
Tresch, Marie .....	Piano .....	Glengarry
Truitt, Alonzo .....	Voice .....	Bozeman
Valleau, Vie H.....	Piano, Voice, History.....	Porcupine
Walker, Cecil .....	Voice .....	Bozeman

Ward, Earl .....	Violin .....	Bozeman
Wilson, Mrs. R. O.....	Piano, History .....	Bozeman

**FARMERS' AND HOMEMAKERS' SHORT COURSES.**

Alldritt, I. ....	Bozeman
Adams, Mrs. A. D.....	South Cottonwood
Ayres, Silas E.....	Bozeman
Alldritt, Mrs. I.....	Bozeman
Allen, A. E.....	Fort Benton
Axtell, C. E.....	Bozeman
Atkinson, Mrs. A.....	Bozeman
Austin, Etta .....	Great Falls
Allison, Francis E.....	Sedan
Allsop, Ezra.....	Bozeman
Bradley, J. H.....	Cascade
Bobbitt, George W.....	Manhattan
Berglund, Mrs. A. C.....	Bozeman
Bull, Fred W.....	Bozeman
Bullard, Hattie.....	Bozeman
Brewer, Mrs. A. D.....	Bozeman
Boddy, D. S.....	Bozeman
Bryan, Charles.....	McLeod
Blocher, Addie S.....	Billings
Baker, Helen.....	Josephine
Boddy, George F.....	Bozeman
Briggs, H. A.....	Victor
Barker, Lizzie.....	Townsend
Bishop, Marie G.....	Bozeman
Brook, Mary E.....	Bozeman
Border, J. E.....	Bozeman
Bergh, Elmer V.....	Redstone
Burgoyne, James H.....	Whitehall
Blackmaar, E. J.....	Huntley
Blankenship, E. V.....	Bozeman
Burnes, Robert E.....	Cardwell
Cordry, James E.....	Bozeman
Courtney, Mrs. W. J.....	Belgrade
Claness, Laurence .....	Huntley
Cooley, Grace C.....	Bozeman
Cobleigh, Mrs. William M.....	Bozeman
Cooley, Mrs. R. A.....	Bozeman
Cehrs, Adda V.....	Bozeman
Cunningham, Mrs. R. J.....	Bozeman
Carpenter, L. M.....	Clyde Park
Cravath, Fred J.....	Sidney

Chamberlin, Nathaniel .....	Whitehall
Cresmas, W. J. ....	Joliet
Dawes, Mrs. J. H. ....	Bozeman
Devore, James N. ....	Bozeman
Deskin, James .....	Manhattan
Daniels, Richard H. ....	Hamilton
Endicott, Roy .....	Hysham
Frederick, Mrs. Tom .....	Augusta
Fletcher, Mrs. Fred .....	Bozeman
Fortman, Mrs. Maud .....	Bozeman
Fox, Edwin .....	Missoula
Feagins, Mrs. Maude .....	Bozeman
Fitzgerald, James J. ....	Salesville
Garnett, John E. ....	Willow Creek
Gaffney, Mrs. Pat. ....	Bozeman
Gilechrist, Edgar .....	Belgrade
Gray, Mrs. Charles W. ....	Bozeman
Graw, Earl W. ....	Burns
Gord, Lee E. ....	Belfry
Goodhue, J. L. ....	Fort Benton
Gerlach, C. W. ....	Hamilton
Hennepe, F. G. ....	Manhattan
House, Miss Lizzie .....	Bozeman
Hulbert, Pearl .....	Bozeman
Henry, Mrs. Nettie .....	Bozeman
Houston, Mrs. E. L. ....	Bozeman
House, W. H. ....	Bozeman
Hart, Louis L. ....	Power
Johnson, Mrs. M. R. ....	Bozeman
Jenkins, Mrs. Mary B. ....	Bozeman
Jackson, P. V. ....	Bozeman
Jackson, Ernest W. ....	Harrison
Jennison, Alice W. ....	Bozeman
Kinney, Martha B. ....	Bozeman
Kimm, R. H. ....	Manhattan
Kaetzer, George B. ....	Norris
Kinney, Mrs. H. L. ....	Bozeman
Kiefer, Frank O. ....	Twin Bridges
Lewis, G. M. ....	Manhattan
Lindberg, Erik .....	Livingston
Leach, Lizzie .....	Bozeman
Leach, Martin .....	Bozeman
Lillard, Mrs. L. W. ....	Bozeman
Loughridge, A. H. ....	Wilsall
Lewis, Archie .....	Emigrant
Lillard, Frank .....	Bozeman

Maceimer, Edith E.....	Bozeman
Murphy, Mrs. J. O.....	Electric
Murphy, Ethel .....	Bozeman
Morris, G. T.....	Bozeman
Murray, Thomas R.....	Hobson
Murray, Mrs. Thomas.....	Hobson
McCormick, W. H.....	Billings
Moore, Jesse K. ....	Bozeman
Mehlberg, Frank H. ....	Bozeman
McMartin, Mrs. Cora .....	Bozeman
Martin, G. D. ....	Big Elk
Murphy, J. O.....	Electric
May, Richard C.....	Lowell, Wyo.
Mehlberg, Mrs. Helena .....	Bozeman
McLeod, Mrs. David.....	Bozeman
Martin, Mrs. Jessie R.....	Twin Bridges
Maynard, E. A.....	Bozeman
Morehead, J. H .....	Cascade
Miller, H. D .....	Simms
McCormick, W. F.....	Bozeman
Mvers, G. W.....	Townsend
Martin, J. L.....	Twin Bridges
Moore, Sanford .....	Two Dot
Mead, J. P.....	Huntley
Miller, Hiram S.....	Helena
Morrison, James.....	Bozeman
Nelson, Edward .....	Livingston
Nelson, Samuel.....	Livingston
Nash, W. J.....	Bozeman
Powers, Mrs. F. T.....	Bozeman
Pasha, R. J.....	Bozeman
Paxton, John H.....	Bozeman
Percival, T. P.....	Como
Parker, Mrs. J. R.....	Bozeman
Pierce, Charles M.....	Farmington
Peeples, Olive .....	Bozeman
Powell, Francis F.....	Stevensville
Powers, John J.....	Bozeman
Pierce, Allen .....	Great Falls
Robinson, Mrs. J. W.....	Bozeman
Renstrom, Mrs. Selma .....	Bozeman
Reynolds, Mrs. Edward.....	Bozeman
Rapstad, Jacob .....	Big Timber
Railsback, Edna .....	Billings
Redfield, Mrs. Elvira .....	Bozeman
Rice, Percy .....	Sedan

Reynolds, W. R.....	Madison, S. D.
Reichman, H. Ray.....	Sedan
Rundell, Henry M.....	Pony
Rundell, J. W. ....	Pony
Ring, John P.....	Helena
Rivers, Adolph .....	Absarokee
Refield, Ralph .....	Bozeman
Redfield, J. L. ....	Bozeman
Stimson, George .....	Belgrade
Stewart, William Norman .....	Gateway
Stevenson, T. F.....	Bozeman
Summers, Harry L.....	Bozeman
Seilley, James .....	Billings
Stone, A. W.....	Laurel
Shirlett, Charles D.....	Missoula
Smith, Kirk .....	Livingston
Stanley, Mrs. L. L.....	Bozeman
Stephens, Elvis .....	Pageville
Sparr, William M.....	Bozeman
Stacy, Ned .....	Shirley
Swing, J. L. ....	Sheridan
Shumaker, Charles W.....	Two Dot
Taylor, Mrs. Olney.....	Bozeman
Thompson, Lester H.....	Bozeman
Thorpe, S. C.....	Darby
Trackwell, ——— .....	Floweree
Treat, Mrs. Grace B.....	Bozeman
Treat, Grace E.....	Bozeman
Thorpe, C. M.....	Bozeman
Thompson, F. E.....	Park City
Walbert, John .....	Willow Creek
Walrath, A. J. ....	Bozeman
Woosley, James .....	Bozeman
Wylie, J. M.....	Bozeman
Wright, Fred .....	Roscoe
Wilson, F. M. ....	Belgrade
Widener, Mrs. Carl C.....	Bozeman
Wood, J. C.....	Big Fork
Williams, Joseph B.....	Manhattan
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Warner, J. E.....	Hamilton



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# *Bulletin of the* MONTANA STATE COLLEGE *of* AGRICULTURE *and* MECHANIC ARTS

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# Twenty-First Annual Catalogue

1913-1914

Montana  
State College of Agriculture  
and Mechanic Arts  
Made a Component part of the  
University of Montana



Bozeman, Montana

# Calendar.

1914.

Six Weeks Summer Session Begins.....	June 8
Registration and Examination for Entrance and Conditions	
.....	Monday and Tuesday, September 7 and 8
Instruction Begins.....	8:00 A. M., Wednesday, September 9
Receptions by Christian Associations.....	Friday, September 11
Faculty Reception to New Students.....	Friday, September 18
Music Recital .....	Friday, September 25
School of Agriculture Examinations, to Remove Conditions	
.....	Monday and Tuesday, October 5 and 6
School of Agriculture Begins.....	Tuesday, October 6
Columbus Day, a Holiday.....	Monday, October 12
Standing of Students Reported.....	Friday, October 23
Standing of Students in School of Agriculture Reported	
.....	Friday, November 13
Thanksgiving Recess....	Thursday, Friday and Saturday, Nov. 26, 27, 28
Standing of Students Reported.....	Friday, December 11
Freshman-Sophomore Debate.....	Friday, December 11
School of Agriculture Examinations	
.....	Thursday and Friday, December 17 and 18
Christmas Vacation.....	Begins 12:00 M., Friday, December 18

1915.

Vacation Ends and Second Semester School of Agriculture Begins	
.....	8:00 A. M., Tuesday, January 5
School of Agriculture Examinations to Remove Conditions	
.....	Monday and Tuesday, January 5 and 6
Semester Examinations Begin.....	9:00 A. M., Monday, January 25
Farmers' Week.....	January 25-31
Declamatory Contest for Secondary Students.....	Thursday, January 28
First Semester Ends.....	Friday, January 29
Examinations for Conditions....	Friday and Saturday, January 29 and 30
Registration for Second Semester.....	Tuesday, February 2
Lincoln's Birthday, a Holiday.....	Friday, February 12
Standing of Students in School of Agriculture Reported	
.....	Friday, February 19
Washington's Birthday, a Holiday .....	Monday, February 22
Extemporaneous Speaking Contest.....	Friday, February 26
Interscholastic Basket Ball Tournament	
.....	Thursday, Friday and Saturday, March 4, 5 and 6
Standing of Students Reported.....	Friday, March 12
School of Agriculture Ends.....	Friday, April 2
Oratorical Contest.....	Friday, April 16
Standing of Students Reported.....	Friday, April 23
Campus Day .....	Saturday, May 1



Arbor Day, a Holiday.....	Tuesday, May 11
Examinations Begin.....	9:00 A. M., Monday, May 24
Examinations for Conditions.....	Friday and Saturday, May 28 and 29
Memorial Day, a Holiday.....	Sunday, May 30
Baccalaureate Address.....	8:00 P. M., Sunday, May 30
Field Day.....	10:30 A. M., and 2:00 P. M., Monday, May 31
Music Recital.....	8:30 P. M., Monday, May 31
Class Day Exercises.....	Tuesday, June 1
President's Reception.....	9:00 P. M., Tuesday, June 1
Commencement.....	10:30 A. M., Wednesday, June 2
Alumni Meeting and Banquet.....	Wednesday Evening, June 2
The Summer Session for 1915 will begin.....	Monday, June 7.

## Montana State Board of Education.

### Ex-Officio

GOVERNOR S. V. STEWART, Chairman.....	Helena
ATTY. GEN. D. M. KELLY.....	Helena
STATE SUPT. H. A. DAVEE, Secretary.....	Helena

### By Appointment

CHARLES H. HALL.....	Missoula
J. BRUCE KREMER.....	Butte

(Term expires February, 1914.)

O. W. McCONNELL.....	Helena
WARD H. NYE.....	Billings

(Term expires February, 1915.)

WALTER S. HARTMAN.....	Bozeman
S. D. LARGENT.....	Great Falls

(Term expires February, 1916.)

JOSEPH C. SMITH.....	Dillon
JOHN DIETRICH.....	Helena

(Term expires February, 1917.)

H. H. SWAIN, Clerk of Board.....	Helena
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## Executive Board.

PRESIDENT JAMES M. HAMILTON (ex-officio), Chairman....	Bozeman
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### By Appointment

J. H. BAKER.....	Bozeman
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(Term expires April, 1915.)

W. S. DAVIDSON.....	Bozeman
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(Term expires April, 1917.)

GEORGE R. CALLAWAY, Secretary-Treasurer.....	Bozeman
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# Administrative Officers

JAMES M. HAMILTON, M. S., President.  
FREDERIC B. LINFIELD, B. S. A., Dean of Agriculture  
ARTHUR W. RICHTER, M. M. E., Dean of Engineering  
F. S. COOLEY, B. S., Director of Extension Work  
UNA B. HERRICK, Dean of Women  
JOHN H. HOLST, Principal Secondary Schools  
GEORGE R. CALLAWAY, Secretary and Treasurer  
ROY O. WILSON, B. S., Registrar  
MARY K. WINTER, Librarian  
JOHN C. PARK, Head Engineer

# Faculty

JAMES M. HAMILTON, M. S., (Union Christian College) President.  
Professor of Philosophy and Economics.  
FREDERIC B. LINFIELD, B. S. A., (Ontario Agricultural College).  
Dean of Agriculture.  
ARTHUR W. RICHTER, M. M. E., (Cornell University).  
Dean of Engineering.  
WILLIAM F. BREWER, A. M., (Harvard University) .  
Professor of English.  
MISS LILLA A. HARKINS, M. S., (South Dakota Agricultural College).  
Professor of Domestic Science.  
ROBERT A. COOLEY, B. S., (Massachusetts Agricultural College).  
Professor of Zoology and Entomology.  
WILLIAM D. TALLMAN, B. S., (University of Wisconsin).  
Professor of Mathematics.  
WILLIAM M. COBLEIGH, A. M., (Columbia University).  
Professor of Chemistry.  
JOSEPH A. THALER, E. E., (University of Minnesota).  
Professor of Electrical Engineering.  
ALFRED ATKINSON, M. S., (Cornell University)  
Professor of Agronomy.  
CHARLES S. DEARBORN, B. S., (Kansas State Agricultural College).  
Professor of Mechanical Engineering.  
DEANE B. SWINGLE, M. S., (University of Wisconsin).  
Professor of Botany and Bacteriology.  
ROBERT D. KNEALE, C. E., (Purdue University).  
Professor of Civil Engineering.  
ORVILLE B. WHIPPLE, B. S., (Kansas State Agricultural College).  
Professor of Horticulture.  
FRANK W. HAM, M. S., (Montana State College).  
Professor of Physics.

PAUL N. FLINT, M. S., (University of Illinois).  
 Professor of Animal Husbandry.

HOWARD WELCH, D. V. M., (Cornell University).  
 Professor of Veterinary Science.

MRS. UNA B. HERRICK,  
 Dean of Women and Instructor in Physical Education for Women.

M. HERRICK SPAULDING, A. M., (Leland Stanford, Jr., University).  
 Assistant Professor of Zoology.

MISS HELEN R. BREWER, A. B., (Grinnell College).  
 Assistant Professor of History.

WILLIAM R. PLEW, M. S., (Rose Polytechnic Institute).  
 Assistant Professor of Civil Engineering.

FRANK C. SNOW, C. E., (Ohio State University).  
 Assistant Professor of Civil Engineering.

ROY C. JONES, B. S., (University of Vermont).  
 Assistant Professor of Dairying.

MISS FLORENCE BALLINGER,  
 Assistant Professor of Domestic Art.

MISS LANA A. BALDWIN, (Women's Art School, Cooper Union, N. Y.)  
 Assistant Professor of Art.

RUFUS A. BARNES, B. S., (University of Wisconsin).  
 Assistant Professor of Chemistry.

MISS CARRIE M. CEHRS, A. M., (University of Denver).  
 Assistant Professor of German.

RALPH T. CHALLENGER, B. S., (Kansas State Agricultural College).  
 Assistant Professor of Mechanical Engineering.

LYMAN G. SCHERMERHORN, B. S., (Massachusetts Agricultural  
 College.)  
 Assistant Professor of Horticulture.

IRWIN T. GILRUTH, A. B., (Ohio Wesleyan University).  
 Assistant Professor of English

HARRY M. JENNISON, M. A., (Wabash College).  
 Assistant Professor of Botany and Bacteriology.

WILLIAM O. WHITCOMB, M. S. A., (Cornell University).  
 Assistant Professor of Agronomy.

WILLIAM F. SCHOPPE, M. S., (University of Maine).  
 Assistant Professor of Poultry Husbandry.

JOHN H. HOLST.  
 Principal Secondary Schools and Instructor in English.

MISS FRIEDA BULL, M. S., (Montana State College).  
 Instructor in Mathematics.

MISS FLORENCE WALLIN, A. B., (University of Iowa).  
 Instructor in French and Spanish.

MISS GENEVIEVE LANE (Woman's Art School, Cooper Union, N. Y.)  
 Instructor in Art.

MISS THEDA M. JONES,  
 Instructor in Stenography and Typewriting.

F. CLIFFORD MILLER, B. S., (James Millikin University).  
 Instructor in Mechanical Engineering.

## MONTANA STATE COLLEGE

- FRED KATELY,  
Instructor in Forge and Foundry.
- WILL T. HAINES, B. S., (Montana State College).  
Instructor in Electrical Engineering and Physics.
- MISS ADA ELEANOR HUNT, A. B., (University of Illinois).  
Instructor in Home Economics.
- MISS MARION F. BROWN, A. M., (Columbia University).  
Instructor in English.
- D. L. WEATHERHEAD, M. S., (University of Illinois).  
Instructor in Chemistry and Analyst  
State Food and Drug Laboratory.
- E. L. CURRIER, B. S., (University of Nebraska).  
Instructor in Farm Management.
- PAUL P. McNEELY, Mus. B., (Washburn College), A. B., (Kansas  
State University.)  
Director School of Music and Instructor in Piano.
- U. HOLMES BISHOP (New England Conservatory)  
Instructor in Vocal Music.
- MISS JUNE HARTMAN, B. S., (Montana State College).  
Instructor in Piano.
- FRED O. JACKSON,  
Instructor in Violin and Orchestra.
- LOUIS L. HOWARD,  
Band Instructor.
- CARL GOTTSCHALCK, M. S., (Montana State College).  
Assistant in Chemistry and Assistant Analyst in  
State Food and Water Laboratory.
- JOHN C. PARK,  
Assistant in Engineering.
- OSCAR TRETSVEN,  
Assistant in Animal Husbandry.

## STANDING COMMITTEES.

- ASSEMBLY—Hamilton, Bishop, Gilruth.
- ATHLETICS—Swingle, Schermerhorn, Tallman.
- BUILDINGS AND GROUNDS—Linfield, Richter, Whipple.
- COMMENCEMENT—Hamilton, McNeely, Miss Baldwin.
- PUBLICATIONS—Brewer, Atkinson, Cobleigh.
- REGISTRATION—Ham, Miss Brewer, Holst.
- SCHEDULE—Tallman, Cooley, Kneale.
- STUDENT AFFAIRS—Miss Brewer, Spaulding, Mrs. Herrick, Whitcomb, Miss Cehrs.
- STUDENT EMPLOYMENT—Dearborn, Miss Harkins, Flint.
- RECOMMENDATIONS FOR POSITIONS—Richter, Miss Harkins, Burke.
- GRADUATE STUDIES—Cooley, Atkinson, Thaler.

# Experiment Station

## STATION STAFF.

F. B. LINFIELD, B. S. A., Director.  
R. A. COOLEY, B. S., Entomologist.  
ALFRED ATKINSON, M. S., Agronomist.  
P. N. FLINT, M. S., Animal Husbandman.  
EDMUND BURKE, B. S., Chemist.  
DEANE B. SWINGLE, M. S., Botanist and Bacteriologist.  
O. B. WHIPPLE, B. S., Horticulturist.  
HOWARD WELCH, D. V. M., Veterinarian.  
J. B. NELSON, Superintendent Demonstration Work.  
W. F. SCHOPPE, M. S., Assistant Poultryman.  
REUBEN M. PINCKNEY, A. M., Assistant Chemist.  
\*L. F. GIESEKER, B. S., Assistant Agronomist.  
H. E. MORRIS, B. S., Assistant Botanist and Bacteriologist.  
J. R. PARKER, B. A., Assistant Entomologist.  
LYMAN G. SCHERMERHORN, B. S., Assistant Horticulturist.  
R. F. MILLER, B. S. A., Assistant in Animal Industry.  
\*G. E. SMITH, Assistant Chemist.  
M. L. WILSON, B. S. A., Agricultural Agent.  
CARL H. PETERSON, Agricultural Agent.  
E. L. CURRIER, B. Sc., Assistant in Farm Management.  
B. W. WHITLOCK, B. Sc., Superintendent of Grain Laboratories.

\* On leave of absence.

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In connection with the college, the Montana Agricultural Experiment Station is conducted. The object of this station is to further the interests of the agricultural industries of the State of Montana. This is done by conducting researches and experiments, which may include the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their various stages of growth; the various subjects connected with irrigation; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soil and water; the chemical composition of manures, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly upon the agricultural industry of Montana as may seem advisable.

The experiment station farm, consisting of 380 acres, adjoins the



college grounds. It is provided with the necessary barns, granaries, tool houses, farm implements, live stock, gardens, greenhouses and orchards.

Sub-stations for experimental work in dry farming are maintained in various parts of the state and are conducted independently or in co-operation with the United States Department of Agriculture. A sub-station for experiments in horticulture has been established in the western part of the state.

The Montana Experiment Station is supported by the annual appropriations from the Federal Government under the Hatch and Adams Acts, supplemented by growing appropriations from the state.

The station issues during the year a series of bulletins, which put in practical form the results of the experimental work. These are sent, upon request, to any citizen of Montana who will apply for them, and any such may have his name entered upon a mailing list and receive all bulletins as soon as issued.

Address, Director, Experiment Station, Bozeman, Montana.

## Agricultural Extension Service

F. S. Cooley, B. S., Director.

The purpose of agricultural extension service is to take agricultural science and experience out to farms and farm homes for the assistance of the people. The fruits of experiment and research; the formulated sciences of agriculture, biology, chemistry, physics and home economics as applied to country life, and the best farm experience are the foundation for this extension teaching. These are construed broadly to include the economic, business, social, educational, aesthetic, and ethical as well as strictly productive phases of country life. Home economics and household arts are included with agriculture in this extension service.

From a beginning with a single officer in charge of extension service and temporary assistance secured from the college, experiment station, and outside sources, a permanent division has been created with a director and assistants who are specialists in animal husbandry, home economics, horticulture, agronomy, rural education, and an office force. To this staff of extension workers for state wide service is being rapidly added a corps of county demonstrators in agriculture and home economics, whose work is personal and direct within a limited territory. These county demonstrators are working concertedly under direction of the State extension office in cooperation with the Federal agricultural organization. Members of the college faculty and experiment station staff devote a considerable time to extension service.

The extension equipment at present consists chiefly in a comprehensive agricultural library, stereopticon slides, charts, Babcock testers, and other illustrative and demonstrative material. For extension service in schools, at fairs, on better farming trains and elsewhere, the resources of the college and experiment station are freely drawn upon. Live stock, machinery, scientific apparatus, as well as agricultural, biological and chemical collections, are available for such instruction.

Among the more important lines of extension work are:

- I. **Farmers' Institutes:** Meetings of farm people addressed by speakers of established reputation, for purposes of instruction and inspiration.
- II. **Correspondence:** Instruction by mail, through the press, and by reading and correspondence courses. Reading matter containing information of current interest along lines of agriculture and home economics is sent weekly to all the papers of the state.
- III. **Movable Schools:** Located for the convenience of farmers for systematic instruction by qualified teachers. These schools each have the services of from four to six instructors and their average duration is one week.
- IV. **Better Farming Trains:** Operated in cooperation with railroad companies. These trains carry several cars of illustrative and demonstrative material, and corps of fifteen to twenty instructors.
- V. **Fairs:** The educational value of the country fair is being enhanced by trained judges furnished by the extension office and by demonstration exhibits.
- VI. **High School Lectures and Lecture Courses:** Seventy-five to one hundred lectures in applied science given yearly to Montana high schools. Their purpose is to give instruction in agriculture, home economics, and applied science, adapted to pupils of secondary grade.
- VII. **Rural Education:** Assisting the present educational system in coordinating rural education with country life, introducing agriculture into the rural curriculum, and enhancing the value of country schools.
- VIII. **Industrial Clubs:** These engage boys and girls in practical enterprizes, such as corn contests, potato contests, sewing contests, canned fruit contests, etc., etc. The winners in these county contests are taken to the state fair and entertained and taught under the supervision of college officers.
- IX. **County Agriculturists:** In cooperation with the Federal government and counties of the State, agents are located to assist farmers personally in solving local problems of production, marketing, and country life.

The extension service seeks to coordinate all forces that are at work for rural betterment, whether industrial, business, educational, social, or religious, and to cooperate with them for the greatest efficiency in such service.

## State College of Agriculture and Mechanic Arts

The purpose of the colleges of agriculture and mechanic arts is chiefly to provide industrial education in agriculture, engineering, household economy, and applied science, for the young men and women of the respective states in which they are located. The scope of the Montana State College is set forth in the two so-called Morrill Acts of Congress, which authorized this class of institutions and supplied in part endowment and funds for maintenance; and in an act of the Montana Legislature accepting the land and money grants from the national government.

The first Morrill Act of Congress of July 2, 1862, making a land grant for the partial endowment of the agricultural and mechanical colleges, states that the income from these lands shall be used to maintain colleges "where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislators of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The second Morrill Act of Congress, August 30, 1890, making an annual appropriation out of the treasury of the United States for the further support and endowment of these colleges, provides that this fund is "to be applied only to instruction in agriculture and mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic sciences, with special reference to their application to the industries of life; and to the facilities for such instruction."

The Act of the Montana Legislature, approved February 16, 1893, accepts these grants of lands and money and provides that the Montana State College shall have for its object "instruction and education in the English language, literature, and mathematics, civil and mechanical engineering, agricultural chemistry, animal and vegetable anatomy and physiology, the veterinary art, entomology, geology, and such other natural sciences as may be prescribed by the State Board of Education; political, rural and household economy, agriculture, horticulture, history, book-keeping, and especially the application of science and the mechanical arts to practical agriculture in the field, and irrigation and the use of water for agricultural purposes."

The Thirteenth Legislative Assembly passed an Act which provides that the State University at Missoula, the College of Agriculture and Mechanic Arts at Bozeman, the School of Mines at Butte, and the Normal School at Dillon shall constitute the University of Montana.

The control and supervision is vested in the State Board of Education, which appoints the president, faculty and such other officers and employees for each of the various institutions of the University of Montana as the said Board may deem necessary. Degrees and diplomas shall run from the University of Montana and must specify substantially the course of study which the graduate has completed.

#### ENDOWMENT.

The Enabling Act, providing for the admission of Montana into the Union, approved February 22, 1889, Sec. 16, grants 90,000 acres of land to Montana for the use and support of an agricultural college according to the terms of the Act of Congress, July 2, 1862, and Sec. 17 grants an additional 50,000 for the same purposes, and subject to the same conditions and limitations as the other grant. The 140,000 acres of land cannot be sold for a price less than \$10.00 per acre, and the principal, together with all money received from the sale of timber, is to be invested as a permanent endowment. The unsold lands may be leased and the rentals, together with the interest on the permanent endowment, shall be used for the maintenance of the college.

The Act of Congress of August 30, 1890, appropriates \$25,000 annually out of the treasury of the United States. By the Nelson bill, passed March 3, 1907, this amount was increased annually by \$5,000 each year, beginning in 1907, until now the total annual appropriation has reached \$50,000, at which figure it is to remain.

#### LOCATION.

Bozeman, the county seat of Gallatin county, is on the main line of the Northern Pacific railroad, and on a branch of the Chicago, Milwaukee and Puget Sound railroad. For convenience, healthfulness and beauty of surroundings, the location is unsurpassed. The college is situated on an elevation which commands a view of one of the most fertile valleys in the world, covered far and wide with grain fields, and hemmed in on all sides by lofty mountains.

Bozeman is a city of homes and churches, with a wholesome moral environment. It is a most desirable residence city for families who wish to educate their children. Expenses are moderate and there are all the conveniences of a modern city. The college is reached from the railroad stations and city by the electric car line.

#### CAMPUS AND FARM.

The grounds and farm contain three hundred and eighty acres. Forty acres in the immediate vicinity of the buildings constitute the campus and recreation grounds, which are in lawn, interspersed with flower beds, shrubbery, trees and driveways. The remainder is used for farming and experimental purposes.



## BUILDINGS.

College Hall, situated in the center of the college campus, is a substantial structure of brick and stone, having a total length of one hundred and twenty-eight feet and a width of ninety feet. It is three stories high, and has a basement, which furnishes quarters for mechanical drawing and three class rooms. On the first floor are offices for the president and secretary, one room each for the Young Men's and the Young Women's Christian Associations, three large class rooms and the reading room and library. The north half of the second floor is devoted to the art department, the arrangement being such that three large rooms can be thrown together, by sliding doors. The south half of the second floor is used by the department of civil engineering, and has one office, one seminar room, two recitation rooms and a drawing room. The third floor contains the large assembly hall and seven class and music rooms.

Hamilton Hall.—This is the new dormitory for women. It was named by the faculty for the late Mrs. James M. Hamilton. It is one hundred twenty by fifty-eight feet, three stories and basement. It is constructed of brick with hard wood floors and Oregon fir finish. It is equipped with steam heat, electric lights and baths. The rooms are single and in suites, and all rooms have both hot and cold water. In the basement are the store rooms, laundry, quarters for servants, kitchen and large dining room. The first floor contains the reception rooms, the Dean's suite, guest room and a number of rooms for students. The second and third floors are for students.

Agricultural Hall is a three-story building, one hundred and fifty feet by sixty-eight feet, pressed brick, tile roof, maple floors and modern equipment throughout. The north half of the first floor contains the quarters for dairying, consisting of storerooms, office, class room, butter and cheese rooms and laboratories. The south half of the first floor is used for horticulture and has seed room, office, class room, work room, and laboratory. The north half of the second floor is occupied by the agronomy department, with office, class room, dry land office and soil and grain laboratories. In the south half are offices for the director of the experiment station, superintendent of farmers' institutes, class room, office and laboratory for the department of animal industry. The third floor is devoted to home economics, and contains two large kitchen laboratories, two dining rooms, two class rooms, three sewing rooms, offices and one room for training in nursing.

Adjoining the Agricultural Hall on the south is the new greenhouse with iron frame, cement floors and modern construction throughout. In the center of the front is a palm room 39 feet square and on both sides flower and vegetable rooms, 28 to 25 feet. Through the center is a plant breeding room, 98 by 20 feet, and on the west side a propagating room, 98 by 9 feet. The entire house is 98 feet by 68 feet, and joined to the agricultural building by a brick work room, 57 by 10 feet.



The Chemistry and Physics Building is located west of College Hall. It is 60 by 100 feet, of pressed brick, and is three stories high, including the basement. The basement is occupied by the physics lecture room, chemistry lecture room and laboratory, the mineralogical and assay laboratory, and the museum of geology and mineralogy. The main floor is occupied by the office and department library, a lecture room, the food laboratory and the experiment station laboratory. The east half of the second story contains the laboratories for physics, and the west half the qualitative and quantitative laboratories.

The Biology Building, consisting of three stories and basement, is brick veneered. On the top floor is a lecture room and a museum containing the zoological collections. On the floor below are three laboratories for bacteriology, botany and zoology, and an office and work room for the botanist. The west half of the first floor is a large laboratory for general biology, and the east half is occupied by the office, library and work room for the entomologist. The basement contains work rooms, class room, store rooms, herbarium room, and dark room. Attached to this building on the south is a greenhouse, 72 by 50 feet, for botanical purposes, and an insectary, 18 by 10 feet, for the study of living insects. The green house is divided into two rooms, one for experimental work and the other for laboratory use.

The Engineering Laboratory is a two-story building 94 by 35 feet, with a frame annex 36 by 20 feet. The first floor contains the dynamos, motors, and other machinery and apparatus, offices and students' reading room. The second story is occupied by the storage battery, photometer and electric light rooms, class rooms and offices. The first floor of the annex contains the cement laboratories, and the second floor is used for electrical designing. There is also a laboratory space 43 by 144 feet occupied by materials testing machines, a refrigerating machine, various steam and gas engines, steam and oil tractors, etc.

The Power House is a brick building, 76 by 32 feet. It contains a 125 horsepower Stirling water-tube boiler, and 125 horsepower Root water-tube boiler. An 85 horsepower engine is directly connected with a 40 K.W. dynamo to furnish power for electric lights, the ventilating fans and the shops. There is also a 16 horsepower vertical type of engine and a 10 horsepower engine, which drives the fan for the power house stack.

The shops are in a one-story frame building. The main part is 60 by 100 feet and contains a forge shop, 27 by 60 feet, a machine shop, 44 by 72, an office, a wash room, and a tool room. It has one wing 36 by 50 feet for woodwork, and another 36 by 48 feet for foundry.

The Gymnasium is a frame building. The main part is 100 by 60 feet, has hard wood floor, and on the ends and sides are permanent seats, amphitheater style. It furnishes a convenient place for gymnasium practice, basketball and other indoor athletics. An addition at the rear and sides, 90 by 14 feet, provides a director's office, two locker

rooms, dressing room for women, shower and needle bath rooms, and a material room.

The Cattle Barn is a two-story frame building, 120 by 82 feet, and of fine architectural appearance. On the first floor is the dairy stable, quarters for young stock, a stock judging room, 40 by 40 feet, box stalls, feed bins and offices. The second story is used for storage of hay. All stables have cement floors and iron stalls.

The Veterinary Building is a two-story frame structure, 25 by 40 feet, with a one-story wing, 20 by 40 feet. On the first floor are the office of the veterinarian, two laboratories and an operating room. The second floor contains a laboratory and a class room.

The Horse Barn is a two-story frame building, 86 by 44 feet. It contains a living room, carriage room, feed bins, fourteen single stalls, three double box stalls, and space for 100 tons of hay.

The Beef Cattle Barn is 50 feet square, with two wings each 24 by 28. It is equipped for feeding experiments and has feeding pens, space for hay, grain bins, and weighing room.

The Sheep Barn has a main part, 40 by 50 feet, and two wings, one 20 by 72 feet, the other 20 by 88 feet. In addition to the pens this building is provided with root cellar, wool and shearing rooms, hay loft, feed bins, and room for the attendant.

The Seed Barn and Granary is a two-story building and affords ample storage room for the field crops on the station farm.

The Piggery consists of a main building, 30 by 35 feet, with two wings, 16 by 50 feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each, for the hogs.

The Poultry Plant consists of two buildings. One is 122 by 15 feet, with a center extension 40 by 20 feet. The center contains the feed room, office, laboratory and living room. Underneath is the incubator cellar. One wing is a brooder house and the other has six pens with yards. The other house is 120 feet long and provides eight pens.

### HAMILTON HALL.

Hamilton Hall is the college home for women. This building is completely furnished. All modern conveniences, such as hot and cold water in the rooms, baths, steam heat and electric lights, are furnished. The Hall is under the supervision of the dean of women and the residents have the care and training necessary for a family of students. The price of rooms (including board) varies according to location and size of room:

One in single room.....	\$24.00
Two in single room, each.....	22.50
One in double room.....	26.00
Two in double room, each.....	23.00
Two en suite, each.....	26.00
Three en suite, each.....	24.00

The above prices are for a calendar month. Of these amounts \$18.00 is for table board and the remainder for room rent. Application for rooms in the hall may be made at any time to the dean of women, or to the secretary of the college, and must always be accompanied by a deposit of \$5.00 to insure a reservation. This amount will apply toward payment of bills in the fall or will be returned if the secretary is notified before September 1st. Residents who leave the Hall before the close of the semester will be required to pay the room rent till the end of the semester. Payment for room and board must be made on the fifteenth of every month in advance, and after five days thereafter an extra charge of \$1.00 per week will be made as long as the bill remains unpaid, unless arrangements have been made to defer payment. Complete arrangements are made for the reception of the residents the day before registration day, and no deduction will be made for late arrivals. The Hall will not be open for occupancy until the day before registration day. No deduction is made for absence at week ends or during vacations, except at the Christmas holidays, when room rent only will be paid. The residents may have guests at meals by making arrangements for same at the dean's office, the day before, and may also have the privilege of the laundry on Saturdays by paying a small fee. The residents are expected to furnish their own towel supply, dresser and table scarfs, and have same laundered; also a napkin ring and any room decorations they may fancy.

#### ROOM AND BOARD FOR MEN.

There is no men's dormitory connected with the college, but about twenty young men can be accommodated at the club on the campus, where rooms and board may be had for \$20.00 per month. Students who do not live in Bozeman, or at the club, find room and board in private families convenient to the college, at from \$22.00 to \$25.00 per month. The total college expense for the year, including tuition, books, room, board and incidental expenses may be estimated from \$250.00 to \$350.00. A list of approved places with prices and accommodations is kept in the registrar's office. A committee of students meets all trains on registration days and at other times on request, and aids in finding satisfactory locations. Students arriving in Bozeman in the day time should take car from the depot to the college.

#### LUNCH COUNTER.

A room on the top floor of the agricultural building, adjoining the College Union rooms is used for a lunch counter. All students and others who desire to take their meals at the lunch room are served at a very reasonable expense.

## FEES.\*

1—Annual matriculation fee for college, art, and school of home economics and mechanic arts courses.....	\$12.00
2—Annual matriculation fee for school of agriculture.....	6.00
3—Extra fee for late registration.....	\$2.00 or \$4.00
4—Special fee for removing condition caused by absence.....	2.00

## DEPOSITS.\*

Agriculture—Agronomy (2) per semester.....	\$ 2.00
Animal Ind. (21), (22), (f) per semester.....	2.00
Horticulture (1) per semester.....	1.50
Horticulture (4) per semester.....	5.00
Horticulture (6), (a) per semester.....	1.00
Art—Art (1), (4), (5), (6), (7), (8), (8c), (9), (15), (16), (17), (a) or (b) per semester.....	1.00
Art (7a), (7b) per semester.....	2.00
Art (2), (3), (13), (14) per semester.....	3.00
Art (10), (11), (12), (13) per semester.....	5.00
Biology—Biology (a) or (c), per semester.....	1.50
Biology (4), (5), (6), (7), (9), or (17) per semester.....	2.00
Biology (12) per semester.....	7.00
Biology (10) per semester.....	6.00
Biology (1), (2), (3), (11), or (13) per semester.....	3.00
Chemistry—Chemistry (1) per year.....	8.00
Chemistry (2), (3), (4), (5), (7), (8), (14), (17), (18), per semester.....	8.00
Chemistry (11) per semester.....	6.00
Engineering—C. E., (1), (1a), (4), (11), (19), (28), (29), (30), (31), (33), per semester.....	1.50
E. E. (4), (6), (10), or (12), per semester.....	3.50
M. E. (2), (2a), (14), (15a), (17), (21), (27) per semester.....	2.00
M. E. (4), (4a), per semester.....	1.50
M. E. (6) per semester.....	4.50
M. E. (20), (28), per semester.....	5.00
A. E. (1), (8), per year.....	3.00
A. E. (2), per semester.....	1.50
A. A. (4), (6), (10), per semester.....	1.00
Mechanic Arts—M. A., (e) per year.....	4.00
M. A. (b) per semester.....	5.00
M. A. (c), (r) per semester.....	2.00
M. A. (d), (h) per year.....	3.00
M. A. (f) per year.....	4.50
M. A. (k), (l), (m), (n), (o) per year.....	1.00

\*A fee is a fixed charge and no part is returned. The deposits cover the cost of materials and breakage in the laboratories and any unused balance is returned.



M. A. (s) per semester.....	3.00
M. A. (a) per semester.....	4.00
Home Economics—H. E. (1), (5), (6) per semester.....	4.00
H. E. (2), (4) per semester.....	5.00
H. E. (13), (c), (b), per semester.....	1.50
H. E. (15), (16), (d) per semester.....	.75
H. E. (3), (7), (12), (14) per semester.....	.50
H. E. (g) per year.....	6.00
H. E. (11) per semester.....	2.00
H. E. (a) per semester.....	1.00
H. E. (h) per year.....	5.00
H. E. (j) per year.....	.50
Physics—Physics (a) per year.....	1.00
Physics (1a) per year.....	2.00
Physics (2) per year.....	3.00
Physics (4), (9), per semester .....	2.00
Physics (5) per semester.....	3.00
Typewriting (3) or (4) for use of machine for one year.....	5.00

## ADMISSION.

Admission to the freshman class, in any of the college courses, is granted: (a) By a certificate of graduation from an accredited high school. (b) By examination in the subjects required by the college for entrance. (c) By faculty approval of grades from other than accredited high schools. (d) By graduation from the school of home economics and mechanic arts.

Candidates for admission to the school of home economics and mechanic arts and the school of agriculture must have completed the eighth grade in the public schools or its equivalent. There are no set requirements for music and the short agricultural courses, all being admitted who give evidence of being able to profit by the work. All candidates for admission to the institution in any department whatever are required to present the requisite diplomas or certificates for work previously done in other schools, and no registration is complete until such credentials are presented and passed upon.

## ENTRANCE REQUIREMENTS.

Fifteen units are required for admission to the freshman class in any college course.

Any one with not less than thirteen units may be admitted conditionally, but the units of preparatory work which have not been offered at entrance must be given preference over college subjects.

A unit for admission shall consist of work to the amount of five recitation periods per week of forty-five minutes each or four recitation periods per week of sixty minutes each, for a year of not less than thirty-six weeks.



Two periods of laboratory, shop work, or drawing shall count as one recitation.

In accordance with the present rules of the State Board of Education the following are required of all applicants for admission without condition to the freshman classes:

- 1—English composition and literature, 4 units.
- 2—Language other than English, 2 units.
- 3—Mathematics, 2 units.
- 4—Science, 1 unit.
- 5—History, 1 unit.

The remaining units will be selected from the following:

- 1—Language other than English, 4 units.
- 2—Mathematics, 2 units.
- 3—Science, 3 units.
- 4—History, including civics and economics, 3 units.
- 5—Drawing, 2 units.
- 6—Commercial subjects, 4 units.
- 7—Industrial subjects, including home economics, mechanic arts and agriculture, 6 units.

Admission without condition to the courses in engineering requires three years of mathematics and one year of physics.

## REGISTRATION.

**Matriculation.** Students entering the college for the first time must present their credentials or pass examination to determine their standing; and until such credentials are passed upon by the registrar or until examinations are passed in the subjects which may be required, the applicant for admission will ordinarily not be admitted to class work. This means that graduates of accredited high schools must bring to the college a recommendation certificate (forms will be furnished by the registrar), showing just what subjects credit is asked for, just how much time was given to such subjects and the grades attained. In addition to this, graduates from high schools not accredited may be required to pass examinations in the subjects offered. In the case of graduates from the eighth grade of the common schools, the certificate of examination must be brought to the college.

**Time for Registration**—The time set for registration of students is the first Monday and Tuesday of the first semester, and the first Tuesday of the second semester. The classroom work begins on the first Wednesday morning of each semester. No students will be registered on Wednesday, Thursday or Friday of the first week of each semester, except at the convenience of class officers between four and five in the afternoon. Those who fail to present themselves for registration before the first Wednesday in either semester, will be permitted to register later in the first week, only upon the payment of a special fee of \$2.00 in addition to regular fees. Those who apply for registra-

tion after the end of the first week of each semester will be registered only upon payment of a special fee of \$4.00 in addition to the regular fees. All special fees so collected shall go into the miscellaneous college fund. The faculty may at its discretion refund the special fee of any student, after the third month of the semester, upon definite proof that the tardy registration was necessary.

### HOW TO REGISTER.

I. All students who have registered here before—except graduates of the preparatory department registering as freshmen—will go directly to their class officers and obtain a class entrance card.

II. Those who have not registered here before and graduates of the preparatory department will:

(1) Fill out application blank.

(2) Secure the signature of the registrar.

(3) Take this signed application blank to the class officer in whose course registration is desired.

(4) From him secure a class entrance card.

III. After securing class entrance card, pay fees at secretary's office.

IV. Present class entrance card with secretary's stamp at the office of the registrar for approval.

Unless permission is granted by the faculty, class officers will register all students in accordance with the rules governing prerequisites, failures and number of credits. The registrar will examine all credentials for admission, and all grades earned in this and other institutions and report any irregularities in registration to the faculty. No registration shall be considered final until approved by the registration committee or the faculty.

**Amount and Regularity of Work.**—Students under twenty-one years of age will be admitted only to regular courses or to work as nearly regular as their preparation allows, unless on special action of the faculty. Students over twenty-one will be admitted to such work, not less than twelve credits (allowance being made for music), as the schedule permits and their class officers approve, and the twelve credits shall include at least six credits of lecture or recitation work.

**Change of Registration.**—A student desiring to change his studies will present his request to his class officer, who, after consulting all teachers interested, will take such action as he may deem best. Change in registration will be made after four weeks for extraordinary reasons only. Requests for change in registration will not be considered during the last eight weeks of a semester. A change in course of study is allowed by a vote of the faculty only.

**Credits Necessary for Registration.**—It is the sense of the faculty that any student not passing in ten credits is wasting his time, and ordinarily he will not be re-registered when he has failed to pass in ten credits the preceding semester.

**Registration by Mail.**—Most of the details of registration can be arranged in advance by mail, and students are requested to arrange their work so far as possible in this way. Those who enter the institution for the first time should write several days in advance of the college opening, enclosing their credentials, as specified in the paragraph on matriculation above, to the registrar of the college, and should state the work which they wish to take. These documents will be examined and the student's classification ordinarily be determined before his arrival, so that much time in registration may be saved. Those who have been already enrolled in the institution should send a letter to their class officers several days in advance of the registration days, telling clearly the work which they plan to take, and in case of elective subjects, stating briefly the reasons for their choice.

If these steps are taken by students, registration should be completed with a minimum expenditure of time; but no student's registration will be complete until he applies at the college in person.

Students who plan to arrange their registration by mail, as specified above, should study carefully the entrance requirements for the courses in which they are interested, and the prerequisites to the various subjects which they wish to take up.

### ABSENCES.

Students absent from required exercises are reported at the close of each day to the president's office. Excuses for absence are not required, but students are subject to discipline by the class officers' committee at any time for absences from required exercises. Whenever the number of absences in any class during a semester exceeds twice the number of credits in the course the student does not receive a passing grade in that subject until the work has been taken up. Work shall be made up by a special examination or in such other manner as the instructor may prescribe, and a fee of \$2.00 must be paid to the secretary of the college before a student can make up work on account of absence, but the class officers' committee may remit the fee on recommendation of the instructor. The instructors deal with tardiness in such manner as they deem best.

**Leave of Absence.**—When it is necessary for a student to be absent from the city, application must be made to the president for leave of absence. A leave of absence is justification for absence from class, but does not give relief from the work omitted.

### GRADES.

**Passing Grades.**—Passing grades are marked A, B, C or D. An average standing from 90 to 100 is A, from 80 to 90 is B, from 70 to 80 is C, and from 60 to 70 is D.

**Conditions and Failures.**—Work not of a passing grade shall be marked E, if in the judgment of the instructor it can be made up or completed without repeating the course in class. Work not of a

passing grade shall be marked F, if in the judgment of the instructor it cannot be made up or completed without repeating the course in class. A mark of E is a condition and may be removed by an examination or in such other manner as the instructor may prescribe. Examinations for removing conditions shall be held on the days designated in the college calendar. A mark of F is a failure and must be made up by repeating the subject in class. When a condition is not removed by the time the subject is offered the following year it lapses into a failure. The above marks apply to laboratory, shop work, drawing and other exercises, as well as to lecture and recitation courses.

Students whose work is unsatisfactory will be reported to the class officer and the president, and information will be sent to the parents or guardians.

**Credits.**—For convenience in estimating the requirements for a degree, the following rules are laid down: One hour a week, for a semester, of recitation or lecture work, or two and one-half hours a week for a semester of laboratory, shop, library work, or drawing, shall count as one credit.

If for any reason the full time is not occupied in the shop, laboratory, drawing room or library, the remainder shall be used under the supervision of the instructor for outside work.

No regular student may take in any one semester work amounting to less than twelve credits, nor more than nineteen, unless a greater number are prescribed in the course.

Grades brought by a student from another institution will be accredited in this college only after personal conference with and approval by the head of the department in which credit is desired.

## GRADUATION AND DEGREES.

**Bachelor's Degree.**—Candidates for the bachelor's degree must complete satisfactorily one of the college courses as outlined and not less than 130 credits; including also a thesis the value of which in credits shall be determined by the instructor concerned. Students who are relieved for any reason of the requirements in military drill or gymnasium shall present four additional credits in some other subjects.

The degree of Bachelor of Science is conferred upon students completing the work prescribed in any one of the college courses and the name of the course taken is placed on the diploma.

In order to complete a course satisfactorily and receive a degree a student must earn as many points as there are credits in the course. In calculating points, A grades count three times as many points as credits, B grades two times, C grades the same number and D grades zero.

All students whose points are two and one-fourth times the number of credits at the time of graduation will receive the degree "With Honors."



**Master's Degree.**—Master's degree work is offered by some departments of the college, and this may be arranged by conferences with the professor in charge. For admission to this, the candidate must hold a Bachelor's Degree from this college or another of at least equal rank, and in the line of work for which he applies for Master's Degree, he shall have sufficient preparation in his major subject to enable him to carry on independent investigations. He shall complete a full year of resident study.

There shall be one major subject and one or two minor subjects. At least one-half of the work must be done in the major subject. The plan of the work must be approved by the Faculty Committee on Graduate work by October 1. The candidate shall also present a thesis embodying the results of independent investigation, which may be a part of the credits required for the major subject. He shall also pass an oral examination on his graduate work before a committee of not less than five members representing the departments offering his major and minor subjects and two or more allied departments.

**Engineering Degrees.**—Resident graduates in engineering may earn the degree of Civil Engineer, of Electrical Engineer, or of Mechanical Engineer on the same basis as candidates earn the degree of Master of Science. Non-resident graduates in engineering must have at least three years of successful professional experience, must present an acceptable thesis, and must pass an examination before the special committee on degrees.

### MISCELLANEOUS.

**Government.**—Students are expected to conduct themselves as ladies and gentlemen; those who fail to comply with this demand will be requested to leave the institution.

**Work for Exhibition.**—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for the period of one year.

**Student Organizations.**—All public performances, given by students or student organizations, using the name of the college, will be under the supervision of the committee on student affairs.

So far as possible all college gatherings will be held on Friday and Saturday evening. This includes class and student organizations. Students will not be out evenings from Monday to Friday except to attend something of unusual interest and value.

**Military Drill.**—All male students, except aliens, those physically disqualified, members of the junior and senior classes, and student assistants, are required to take military drill, satisfactory work being requisite for graduation.

Military drill is in charge of a United States Army officer and a minimum of two years' drill is required. Each student in military drill must provide himself with a uniform, which is purchased through the secretary of the college, and costs about fifteen dollars.



Students who are relieved for any reason of the requirements in military drill, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

**Music as an Elective.**—Music to a total of not more than four credits may be counted toward a degree in those courses which allow free electives. To those regular students who elect music the college will furnish free one thirty-minute lesson a week during the junior and senior years, or either semester of either year; and the work may be elected in either vocal or instrumental music.

**Assembly.**—Students are required to attend the assemblies held on the second and fourth Fridays of each month and all special assemblies. The programs at these assemblies consist of addresses, music recitals, illustrated lectures, etc. Meetings of student organizations are held on the first and third Fridays of each month.

**Honorable Dismissal.**—Students intending to sever their connection with the institution, either indefinitely or permanently, should report as soon as possible to the president, either in person or in writing, giving proper explanation, and should apply for an honorable dismissal. Students leaving the institution without such honorable dismissal (except at the end of the college year), will not be readmitted to the college at any later time, nor will any reports or grades in credit for work done here be sent out until satisfactory explanation is made.

## COLLEGE ORGANIZATIONS.

**Young Men's Christian Association.**—The association is undenominational and is well fitted to promote the moral and religious life of students. It conducts mission and Bible study courses, and prayer meetings and secures addresses by religious workers. The association promotes good fellowship by giving social entertainments, assists new members to get started in college life and aids in securing employment for those who wish to work their way through college.

**Young Women's Christian Association.**—The object of this association is the symmetrical development of Christian womanhood. It co-operates with the Y. M. C. A. in its social and religious work among the students. It conducts devotional meetings and carries on systematic Bible study. Several delegates are sent to the Northwest Conference each year and an active interest is maintained in the state association.

**Debating Council.**—The management of the work in inter-class and intercollegiate debating, in extemporaneous speaking, and in oratory, is now vested in a debating council, which works in co-operation with the department of English. Annual debates are now held with the Agricultural College of Utah, and the State University, and with the Gonzaga University. There is an established debate each year between the freshman and sophomore classes. There is a state contest in

oratory and extemporaneous address in which five institutions of the state participate.

**The Exponent.**—The students of the college maintain an excellent weekly paper, *The Exponent*, which has also a monthly literary supplement. The paper is well supported by the students and outside advertisers and has become one of the most important and successful of student enterprises. It compares favorably with the best college publications in the United States and affords the members of the staff very valuable literary training.

**The Jack o'Lantern Club.**—The purpose of this club of students is the studying and presenting of the modern drama. The work is done under the direction of the English department.

**Athletic Association.**—This association has general control of all athletic interests of the college, subject to the approval of the faculty. Football, baseball, basketball, track and tennis are maintained. A part of the annual matriculation fee is appropriated to athletics and all students thus become members of this association without additional cost.

**The Handicraft Club.**—This club was organized for those students who are interested in the crafts. The club meets every two weeks in the art department, and members work out original problems in their chosen craft. Members work for their own pleasure and benefit and are privileged to take orders.

**Branch of the American Institute of Electrical Engineers.**—A branch of this society has been organized at the college. Regular monthly meetings are held at which original papers are read or those of the Institute discussed. Students and teachers are kept in touch with practical engineers and their problems. Only regular members or student members of the American Institute are eligible to membership in this branch. There is, however an Electrical Club, which includes all the members of the Institute and all other students in the electrical engineering course.

**The Civil Engineering Society.**—The students of the department of civil engineering organized the society for the purpose of promoting their interests in matters of practical importance to engineering students and alumni. Prominent engineers who have succeeded in special fields frequently meet with the members of the society to discuss the problems of their field. Meetings are held bi-monthly.

**College Band.**—The college band of forty-five members, under the instruction of Mr. Louis Howard, is one of the best amateur musical organizations in the state. The college provides instruments, music and instruction. The band is divided into two sections, beginners and experienced players. This gives a splendid opportunity for those who have never played and those who have some skill in the use of instruments.

**Engineering Society.**—The object is to aid its members financially by purchasing at wholesale rates, books, materials and instruments.

**Agricultural Society.**—All agricultural students are eligible to

membership in this society. Regular meetings are held for the discussion of topics of interest in scientific agriculture with special reference to the possibilities of farm life. A bookstore for the members has been conducted for several years.

**Male Glee Club.**—Men students who have the necessary range and quality of voice are admitted. Music and instruction is free. Rehearsals are held twice a week under the direction of the instructor of vocal music. College and home songs as well as the works of the foremost American composers are studied.

**Ladies' Glee Club.**—This club consists of sixteen voices, otherwise it corresponds with the Male Glee Club. The same type of music is studied, and the rehearsals are held twice a week. Twice a year the clubs appear in joint concerts, performing the works studied, and forming also a mixed chorus. Separate public appearances are frequent.

**Orchestra.**—The M. S. C. orchestra is an organization composed of students of the college. Last year its membership numbered twenty, but it is the aim of the director to have at least forty members for the year 1914-15, in order that they may work on some light symphony music.

**Home Economics Club.**—This club is composed of women students who are working for a degree in home economics. Meetings are held twice a month for the discussion of topics of interest to students in home economics and also to keep in touch with the work of the alumni of this department.

**The Chemical Society.**—The students taking the chemistry course join this society for the purpose of developing an interest in the professional side of the subject and also for studying topics that do not come up in regular class work. Regular meetings are held and abstracts of recent journal articles are presented.

**College Union.**—To provide recreation facilities, especially during the winter months, when outside games are not possible, the College Union has been formed. This organization includes all men students and faculty members in the institution, and has its headquarters in the College Union rooms on the fourth floor of Agricultural Hall. These rooms, which were fitted up during the summer of 1912, include two large game and recreation rooms and one reading room. In the game rooms, pool and billiard tables and the parlor games, such as chess and checkers, are provided. In the larger of these rooms, there is also a piano and good facilities for recreation and social intercourse on the part of the men students. In the reading room is placed an assortment of the popular magazines, as well as desks and all the necessary writing facilities. The general use of these rooms by the student body shows that they have met a very apparent want in the institution.

**Social Clubs.**—Greek letter fraternities are not permitted. Clubs which have for their object the improvement of the social life of their members are authorized. Two clubs of this kind are the Triangle X and the Kayenne. The latter maintains a house in which its members

live. These clubs, like other student organizations, are under the supervision of the faculty.

### CONTESTS.

**Prize in Oratory.**—An annual prize of twenty dollars is given to the winner of the annual local oratorical contest. This is open to all students. The winner represents the college in the state oratorical contest.

**Armstrong Prize in Declamation.**—Hon. F. K. Armstrong, of Bozeman, gives a prize of ten dollars to the winner of the annual declamatory contest of the preparatory school. There is also a second prize of five dollars. Only regular students are eligible.

**Extemporaneous Speaking.**—Hon. Nelson Story, Jr., gives an annual prize of twenty-five dollars toward an Extemporaneous Speaking Contest. Fifteen dollars is given as first prize, and ten dollars as second prize. This contest is open to students of the Preparatory School.

### SCHOLARSHIPS.

The State Board of Education has established a four-year scholarship in each of the accredited high schools for the student who receives the highest average grade in his class. These scholarships are awarded each year by the high school principals for their respective schools. This scholarship excuses the holder from paying any tuition or deposits. Any one winning a scholarship may choose any of the state institutions.

**Federation Scholarship.**—The State Board grants to the Montana Federation of Women's Clubs a scholarship in each of the four state colleges each year. The Federation pays all college expenses of the woman elected, including board, room rent, books, athletic ticket and gymnasium suit.

### ACCREDITED HIGH SCHOOLS.

Following is a list of the accredited high schools of the state:

(1) **City High Schools.**—Anaconda, Belt, Billings, Butte, Chinook, Columbus, Conrad, Eureka, Forsyth, Glasgow, Great Falls, Hamilton, Havre, Helena, Harlowton, Laurel, Libby, Moore, Plains, Pony, Polson, Stevensville, Terry, Victor, Virginia City, Whitehall.

(2) **County High Schools.**—Beaverhead, Dillon; Broadwater, Townsend; Choteau, Ft. Benton; Carbon, Red Lodge; Custer, Miles City; Dawson, Glendive; Fergus, Lewistown; Flathead, Kalispell; Gallatin, Bozeman; Granite, Philipsburg; Jefferson, Boulder; Missoula, Missoula; Park, Livingston; Powell, Deer Lodge; Sweet Grass, Big Timber; Teton, Choteau.

(3) **Parochial High Schools.**—Parochial High School, Butte; Mount Angela Ursuline Academy, Great Falls; Sacred Heart Academy, Missoula; St. Vincent's Academy, Helena.



### EMPLOYMENT FOR STUDENTS.

A number of students earn a part of their expenses while in college. Students expecting to work their way should come with sufficient money to pay their expenses for one semester unless they have engaged work in advance. The college cannot guarantee employment, but those who are willing to give efficient, faithful service have usually found work.

A few students are employed as janitors and as assistants in the shops, laboratories and barns. Others care for furnaces, horses and cows in the city, work in stores and at various kinds of house work. Calls for young lady students to work for their board are numerous.

Students readily find employment at profitable wages during the summer vacation. A large number annually get work with the transportation companies in the Yellowstone National Park as drivers, camp attendants and domestics. Engineering students are placed with the reclamation service, the railroads, and the electric power plants.

A faculty committee aids students to find employment. Those desiring work should write, stating experience and kind of work desired.

### LIBRARY AND READING ROOM.

**Public Depository.**—By Act of Congress the library is now a depository and receives all public documents and other printed matter issued by the United States government.

**Main Library.**—The main library is in two large, well lighted rooms on the first floor of College Hall. The library contains 11,300 volumes, not counting public documents, and about 6,000 pamphlets. It is well supplied with standard works in technology, history, science and literature, as well as with dictionaries, cyclopedias and other reference works. About \$1,500 is spent annually for books and periodicals.

**Department Libraries.**—The agricultural library occupies two rooms on the second floor of the Agricultural Hall. It contains almost complete bound sets for all state experiment station bulletins and United States Department of Agricultural publications, besides a large number of agricultural papers and standard works. One large room on the first floor of the biology building is used for the library and periodicals of the biological department. The library of the chemistry department is located in the office of the chemist in the chemistry building.

### ATHLETICS AND PHYSICAL TRAINING FOR MEN.

The gymnasium is described on page 13 of this catalogue. This furnishes some room for basketball practice and games, for baseball and football practice in bad weather and for gymnasium practice of various kinds during the winter months. A small amount of apparatus is available. The college furnishes the necessary equipment and materials for basketball, football, baseball and track athletics.



The work of this department includes three main lines—the coaching of athletic teams to represent the college in outside contests; the training of such men as present themselves during the winter for work in wrestling, boxing and indoor work; and the general supervision of the physical welfare of all the students through a system of physical examination and prescribed exercises.

The college has been represented in inter-collegiate athletics during the past year by teams in basketball, track athletics, and football. Eligibility in these teams is determined under the rules of the Montana Inter-Collegiate Athletic Association.

At the middle of each college year all the students of the college are requested to present themselves for a thorough physical examination; and on the showing thus made the instructor prescribes certain forms of exercise for each student, and makes certain recommendations regarding diet and hygiene. At each recurring annual examination the improvements are noted and further suggestion made.

**Athletic Field.**—The new athletic field located south of the main building has been completed. It consists of a quarter mile 20-foot cinder running track with a 130 yard straight-away. The inside field is graded for use as a football gridiron and baseball diamond. A neatly constructed grandstand with a seating capacity of 500 has been provided. There are two good cement tennis courts.

### WOMEN'S ASSEMBLIES.

One hour each week is required of the freshman women and all first year girls of the School of Home Economics, also the short courses, special and irregular women students for general assemblies for women; and upon the recommendation of the head of a department this course may be repeated.

The assemblies are under the supervision of the women of the faculty, and include lectures on; personal and social hygiene, dress, the care of the room, wall decorations, bed making, habits, etc.

After the freshman or first year, all women students are required to attend one assembly each month. This course correlates with the every day life of the women.

### PHYSICAL EDUCATION FOR WOMEN.

The aim of the physical education department for women is to develop each girl to her highest economic value, as a unit of society, to the end that when she finishes her college course she may carry forth into life a sane, well balanced, logical mind, high moral character and a strong symmetrical properly functioning body, capable of assuming and performing cheerfully and well the duties of cultured womanhood.

Students who are relieved for any reason of the requirements in physical training, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

**First Year.**—Physical examination on entering. The chief aim throughout the year is to establish good posture and carriage and strengthen vital functions. The work will consist of Swedish body building work, some floor tactics, German rhythmic dancing and games. Class exercises twice a week required.

**Second Year.**—The work for the second year women will consist of lectures and recreational games. Classes required twice a week.

The physical education course for the girls of the School of Home Economics and Short Course will include a physical examination on entering, corrective and recreational gymnastics.

Indoor and outdoor tennis courts are furnished for the women and beginning classes are organized; competitive games are played between classes throughout the year.

A volley ball court makes a good game equipment for women.

All through the two years the course includes lectures on personal hygiene; general deportment for girls; dress from the standpoint of health and appearance; the physiology of bodily exercise. The regulation gymnasium suit and shoes, which may be obtained from a local dealer will be required.

#### BASKET BALL TOURNAMENT AND SPEAKING CONTEST.

The annual high school basket ball tournament and speaking contest is held on Thursday, Friday and Saturday nearest the tenth of March. The railroad fares and the room and board for three days in Bozeman are paid for six basketball players and one speaker from each high school. All accredited high schools are eligible to participate. Rules of eligibility are determined and protests decided by the Montana High School Athletic Association. A cup is awarded the champion team. In connection with the tournament an extemporaneous speaking contest is held.

## ORGANIZATION OF INSTRUCTION.

A. The following four-year college courses, each leading to the degree of Bachelor of Science, are offered:

1—College of Agriculture.

1, Agronomy; 2, Animal Industry; 3, Horticulture.

2—College of Engineering.

1, Civil Engineering; 2, Electrical Engineering; 3, Mechanical Engineering; 4, Chemical Engineering; 5, Architectural Engineering; 6, Irrigation Engineering.

3—College of Industrial Arts and Sciences.

1, Biology; 2, Chemistry; 3, Home Economics; 4, Secretarial Work; 5, Applied Art.

B. The following courses, not leading to a bachelor's degree are offered:

1—School of Home Economics.

2—School of Mechanic Arts.

3—School of Agriculture.

4—Art School

5—Secretarial Work.

6—Music School.

## NOTATION.

In the following tables and descriptions of courses the signs used are as follows: All numbers given in the parentheses are the numbers of the courses and the description of the work may be found by these numbers. So the notation (Math. 3) means that the course referred to is the course in mathematics numbered 3 which is analytical geometry and calculus. The letters of the alphabet without numbers are used in parentheses in the same way to indicate courses of sub-freshman rank. The arabic numbers used without parentheses in the tables and in the description of the courses indicate the number of credits toward graduation allowed for the subject. In the description of the courses the Roman numerals, I and II are used to designate the first and second semesters. M., T., W., Th., F., and S., are used to indicate the working days of the week, and the numerals "10 to 11" or "3 to 4" to indicate the morning or afternoon hours. In the case of elective subjects, no hours are given. The time of the recitations for elective subjects will be announced as the work is called for.

## College of Agriculture

F. B. Linfield, Dean.

This College consists of three departments, viz, Agronomy, Animal Industry and Horticulture. For the first two years the work is the same in all three courses. At the beginning of the junior year the student chooses the group in which he desires to specialize. The aim of this work is to give a thoroughly practical course based on a broad scientific foundation, along the lines of field agriculture, horticulture, live stock, dairying and poultry.

The College is very completely equipped for agricultural instruction. A large agricultural building, thus centralizing the work, a one thousand acre farm, a large orchard and garden, large and well equipped laboratories for the study of soil and crops, for milk testing and dairy manufacturing and for the study of farm machinery, a large greenhouse well stocked with plants, and several barns and other buildings filled with various breeds of live stock including beef and dairy cattle, horses, sheep, hogs and poultry—all these are at the command of the agricultural student.



AGRICULTURE.  
FRESHMAN YEAR.

First Semester.	Second Semester.
English Composition (Eng. 1).. 2	English Composition (Eng. 1).. 2
Public Speaking (Eng. 4)..... 1	Public Speaking (Eng. 4).... 1
General Chemistry (Chem. 1).. 4	General Chemistry (Chem. 1). 4
General Botany (Biol. 9)..... 5	Field Crops (Agron. 1)..... 5
Trig. and Log. (Math. 2a)..... 3	Prin. Plant Culture (Hort 1).. 3
Farm Dairying (An. Ind. 21).. 3	Animal Types (An. Ind. 1).... 3
Drill .... .. 1	Drill ..... .. 1
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19	19

SOPHOMORE YEAR.

Expository Composition (Eng. 2) 2	Expository Composition (Eng. 2) 2
Qualitative Analysis (Chem. 2) 4	Organic Chemistry (Chem. 5) 5
Gen. Des. Phys. (Phys. 1a).... 3	Gen. Des. Phys. (Phys. 1a).... 3
Invertebrate Zoology (Biol. 1). 4	Animal Phys. and Anat. (Biol. 3) 5
General Entomology (Biol. 4). 5	Geology (Geol. 1)..... 3
Drill .... .. 1	Drill ..... .. 1
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19	19

## Course in Agronomy

Agronomy is the science of the field and its crops. It treats of the production and improvement of field crops, the cultivation of soils and the maintenance of their fertility, and general farm management, which is the application of economic business methods to farm practices.

Because of the peculiar agricultural conditions existing in western states, a new agriculture is being developed. The handling of dry farming lands is necessary only in the West. The problems which have to do with irrigation water, and the cultivation of the soil and management of the crops under irrigation must be solved by the western investigators and agriculturists. It is to fit men to deal with these and other questions of production of the farm that this course is offered.

The first two years of the agronomy course are devoted to the study of the natural sciences, languages and some general agricultural work. This places the student in a position to appreciate and intelligently discuss the methods of practice taken up later in the course.

The last two years of the course are designed to give the student clear insight into methods for the cultivation and maintenance of the fertility of the soil; the peculiarities of the growth and handling of different crops; the arrangement, the laying out of the farm, and the principles which govern successful farm management.

With a constantly growing appreciation of the value of the agricultural lands of the West, comes an active demand for young men trained along the lines of practical and scientific agronomy, men who combine college training with practical experience and native ability. Such training is offered to young men in this course. The demand for such students is unlimited, at a compensation not exceeded in any other calling. A few of the many lines open to graduates of this department are: college and experiment station work, agricultural journalism, management of large irrigated and dry farms, management and salesmanship for seed firms, and superintendencies for companies with large land holdings.

With the completion and settlement of Federal irrigation projects, there has come a demand for trained men to assist settlers who may be unacquainted with crop raising under irrigation. The field is an attractive one, both from the point of remuneration, and from the possibility of useful service. The engineering options suggested as electives for the junior and senior years are designed especially for the men who plan to take up this work.

AGRONOMY.  
JUNIOR YEAR

First Semester.		Second Semester.	
Economics (Econ. 3).....	2	Economics (Econ. 3).....	2
Soil Physics (Agron. 2).....	5	Soil Fertility (Agron. 3).....	3
Agr. Chemistry (Chem. 7)....	4	Farm Mechanics (Agron. 4)...	3
Bacteriology (Biol. 12).....	5	Plant Phys. (Biol. 10).....	4
Elective .....	2 or 3	Production (An. Ind. 27).....	3
Irrigation Management		Organic Evolution (Biol. 14)..	3
Mech. Drawing (M. E. 1).....	3		—
	18 or 19		18

SENIOR YEAR.

Farm Management (Agron. 6)	4	Soil Management (Agron. 8)..	2
Prin. of Breeding (Agron. 7)..	4	Common Diseases (Vet. Sci. 7)	4
Plane Surveying (C. E. 1a)...	3	Plant Pathology (Biol. 11)...	4
Prin. of Feeding (An. Ind. 4)..	3	Adv. Grain Judging (Agron. 5)	2
Elective .....	5	Elective .....	7
Irrigation Management		Irrigation Management	
Irr. Engineering (I. E. 1).....	3	Canal Surveying (C. E. 2)....	2
	—	Canal Management (I. E. 3)..	3
	19	Pumping for Irrigation (I.E. 7)	3
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			19

## Course in Animal Industry

The work in animal industry consists of study in judging, feeding, breeding and caring for farm animals. The work in dairying consists of the handling, manufacture and marketing of milk and its various products.

This course is designed to prepare young men for agricultural college and experiment station work, federal government work, farmers' institute work, positions as buyers and salesmen of livestock, teachers of animal industry and dairying in high schools, managers of large livestock and dairy farms, creamery and dairy inspectors, managers of dairy corporations, and community milk depots; and above all, to furnish men with a scientific as well as a practical knowledge to operate their own farms in Montana.

The first two years of this course are given largely to a study of basic subjects, as English composition, mathematics, physics, chemistry, and biology. The last two years are given to special practical and theoretical work in dairy manufactures, handling of milk, judging, breeding and feeding live stock, including poultry, veterinary science, bacteriology and other allied subjects.

This course is given through text books, lectures, practice and observation. Lectures are given by specialists and the student is made familiar with the most modern ideas and acquainted with the methods of the most successful breeders, feeders and dairymen in this and European countries. The work in judging is given by the use of college animals and stereopticon lectures. To secure a variety of animals, excursions are made to stock farms near the college. Advantage is also taken of the live stock on exhibition at the state and local fairs. Practical instruction is also given in compounding rations, making out pedigrees and keeping breeding records.

The theoretical work in dairying is closely followed with practical work in handling separators, testing milk, ripening and churning cream, and by all the actual work in the college creamery and cheese factory. The practical and theoretical are carefully combined.

## ANIMAL INDUSTRY.

### JUNIOR YEAR.

#### First Semester.

Agr. Chemistry (Chem. 7)....	4
Breeds of Live Stock (An. Ind. 2)	5
Bacteriology (Biol. 12).....	5
Poultry Management (An. Ind. 41).....	3
Elective .....	2
Animal Husbandry	
Economics (Econ. 3).....	2
Dairying	
Milk and Milk Testing (An. Ind. 22) .....	2
Poultry	
Elective.....	2

#### Second Semester.

Market Classes and Grades of Livestock (An. Ind. 5).....	2
Animal Nutrition (Chem. 11) ..	3
Common Diseases of Farm Animals (Vet. Sci. 57).....	4
Organic Evolution (Biol. 14) ..	3
Elective .....	6
Animal Husbandry	
Veterinary Physiology (Vet. Sci. 51).....	4
Economics (Econ. 3).....	2
Dairying	
Creamery Butter Making (An. Ind. 23).....	3
Milk Production (An. Ind. 27) ..	3
Poultry	
Poultry Breeds (An. Ind. 12) ..	3
Incubation and Brood (An. Ind. 43).....	3

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### SENIOR YEAR.

Prin. of Breeding (Agron. 7) ..	4
Embryology (Biol. 13).....	4
Prin. of Feeding (An. Ind. 4) ..	3
Farm Management (Agron. 6) ..	4
Elective .....	4
Animal Husbandry	
Adv. Stock Judging (An. Ind. 3) 1	
Swine and Sheep Production (An. Ind. 7).....	3
Dairying	
Economics (Econ. 3).....	2
Elective.....	2
Poultry	
Poultry Breeds and Feeding (An. Ind. 45).....	2
Economics (Econ. 3).....	2

Farm Mechanics (Agron. 4) ..	3
Elective .....	16
Animal Husbandry	
Obstetrics (Vet. Sci. 54).....	3
Breed. Farm Animals (An. Ind. 6) 2	
Soil Fertility (Agron. 3).....	4
Horse and Beef Prod. (An. Ind. 8) 3	
Elective.....	4
Dairying	
Cheese Making (An. Ind. 24) ..	3
Obstetrics (Vet. Sci. 54).....	3
Breed. Farm Animals (An. Ind. 6) 2	
Soil Fertility (Agron. 3).....	4
Economics (Econ. 3).....	2
Elective.....	2
Poultry	
Poultry Houses (An. Ind. 44) ..	3
Market Poultry Products (An. Ind. 46) .....	3
Adv. Poultry Breed (An. Ind. 47) 3	
Economics (Econ. 3).....	2
Elective .....	5

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## Course in Horticulture

The four years' course in horticulture, leading to the degree of Bachelor of Science in horticulture, is designed to prepare students as teachers in agricultural colleges, investigators in the agricultural experiment stations, editors of horticultural papers, managers of fruit associations and superintendents of commercial orchards and fruit plantations. The western United States leads the world in methods of orcharding and disposing of orchard products, and there is a strong and growing demand for persons properly trained to manage the orchard projects now operated throughout the fruit regions of the west. Fruit growing, when done in a scientific way, is extremely profitable and presents an inviting field for the trained horticulturist. The college offers good facilities for a thorough training in all branches of horticulture.

### HORTICULTURE. JUNIOR YEAR.

#### First Semester.

Economics (Econ. 3).....	2
Soil Physics (Agron. 2).....	5
Bacteriology (Biol. 12).....	5
Agr. Chemistry (Chem. 7)....	4
Systematic Pomology (Hort. 4)	3

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#### Second Semester.

Economics (Econ. 3).....	3
Soil Fertility (Agron. 3).....	3
Plant Phys. and Histology (Biol. 10) .....	4
Pomology (Hort. 2).....	3
Organic Evolution (Biol. 14)..	3
Elective .....	2 or 3

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 18 or 19

### SENIOR YEAR.

Plane Surveying (C. E. 1a)...	3
Greenhouse Construction and Management (Hort. 5).....	3
Commercial Fruit Growing (Hort. 7).... ..	3
Prin. of Breeding (Agron. 7)...	4
Elective .....	5 or 6

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 18 or 19

Landscape Gardening (Hort. 6)	3
Vegetable Gardening and Small Fruit Culture (Hort. 3).....	5
Plant Pathology (Biol. 11)....	4
Common Diseases of Animals (Vet. Sci. 27) .....	4
Elective .....	2 or 3

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 18 or 19

**AGRONOMY.**

**Professor Atkinson.**  
**Assistant Professor Whitcomb.**  
**Mr. Currier.**

On the main floor of Aricultural Hall are the soil and grain laboratories and class rooms, modern and thoroughly equipped.

The soil laboratory, accommodating forty-eight students, provides for accurate work in soil physics. Upwards of two thousand dollars have been expended in equipping these laboratories with the most up-to-date fittings and apparatus, in order that the students may enjoy the very best facilities.

In the grain laboratory, specially designed and individual judging tables have been installed. This permits each student to pursue careful and continuous work in grain judging and enables him to become thoroughly familiar with the various grain standards. Vermin-proof storage cases for class materials and standard samples have been provided. These insure the preservation of valuable material as accumulated. Score cards based on Montana conditions have been prepared for wheat, oats, barley and corn, and are used to impress students with the points to be looked for in grain judging work.

For farm management instruction, the farm survey data being accumulated by the Experiment Station is available. This consists of records of farms conducted under various systems of management.

(1) **Field Crops.**—A study of grain crops, root crops, sugar, fibre, and other classes of field crops which may be grown in Montana. The history, classification, management, uses and the possible manufactured products are fully discussed. In this course the students become familiar with the various commercial grain standards and have considerable grain judging practice with the score card. Prerequisite: Biology (9) and (10). Lectures, 3; laboratory, 2. II, 5.

(2) **Soil Physics.**—This course is designed to prepare the students to understand better the effects of the different methods of treating soils, and the influence of these upon moisture, texture, aeration, fertility and production. It comprises a review of the origin, formation and classification of soils and study of the conditions influencing the supply of heat, air and moisture as related to growing plants. The work of the class room is supplemented by laboratory work comprising the determination of such questions as the water-holding capacity and capillary power of various soils, and the effect of mulches and of various systems of rotation on the physical condition of the soil. Prerequisite: Physics (1a); geology (1); chemistry (5). Lectures, 3; laboratory, 2. I, 5.

(3) **Soil Fertility.**—Maintenance of fertility, fertilizers and rotation. The influence of barnyard manure, green manuring and commercial fertilizers upon the quality and yield of the soil and upon suc-

ceeding crops, different rotations and the ultimate effect of different methods of farm management upon the fertility and productive capacity of the soil, and also a study of the preservation of barnyard manure. Prerequisites: Chemistry (7), biology (12). II, 3.

(4) **Farm Mechanics.**—Includes the study of the development, construction, functions and methods of operating, adjusting and repairing implements and farm machinery; also a study of the principles of draft and the production of power, and the care and operation of such farm power machinery as the windmill, gasoline engine, and the different makes of traction plowing machinery. Prerequisites: Physics (1a), agronomy (1 and 2). Lectures, 2; laboratory, 1. II, 3.

(5) **Advanced Grain Judging.**—In this course is given constant practice in judging cereal, grass and forage seeds. Prerequisite; Agronomy (1). Laboratory, 2. II, 2.

(6) **Farm Management.**—This course considers the problems of farm management. The relative profits of different systems of farm management, the relation of the industry of agriculture to other industries, and the social conditions of agriculture are considered. Prerequisites: Agronomy (1, 2, 3, 4). I, 4.

(7) **Principles of Breeding.**—This course considers the different theories of plant and animal improvement, and embraces a study of selection, heredity, variation, atavism and fecundity; also cross breeding and in-breeding with a historical study of their results. Prerequisite: Biology, (14). Lectures, 4. I, 4.

(8) **Soil Management.**—This course includes a study of the most approved methods of handling various soils in their relation to crop production. It embraces a study of alkali, sandy, heavy clay, gumbo, muck, peat and old worn-out soils, as well as a study of the management of irrigated and dry farm lands. Prerequisite: Agronomy (1, 2, 3). II, 2.

(9) **Thesis.**—During the senior year, agronomy students will be allowed four credits if they prepare an acceptable thesis on some subject to be approved by the head of the agronomy department. The subject of this thesis must be decided upon no later than November 15th of the senior year, and must include a literature review and some experimental work along the line of the subject chosen. I and II, 4.

(10) **Farm Management (Documents).**—This course deals with deeds, notes, contracts, property, mortgages, etc., and includes a study of legal principles with which everyone should be familiar. It should be of interest to all students. Elective I, 3.

## ANIMAL INDUSTRY.

Professor Flint.

Dr. Welch.

Assistant Professor Jones.

Assistant Professor Schoppe.

Mr. Tretsven.

For the work in animal industry there are available more than one hundred head of dairy and beef cattle, including pure bred Holsteins, Jerseys, Herefords, Shorthorns, and Angus; some thirty high grade Percheron horses; a large number of pure bred Berkshire, Poland China, Duroc Jersey and Yorkshire swine; and large flocks of Shropshire, Remboullet and Cotswold sheep. During the winter season the live stock used in the feeding experiments is also available for study. Several breeds of fowls are kept for the work in poultry husbandry.

The farm buildings include a dairy barn with silos, beef cattle barn, horse barn, sheep barn, piggery and poultry buildings, all of modern construction and arrangement.

The dairy is equipped with all modern appliances for the manufacture of butter and cheese. Eight hand separators afford the students an opportunity to compare the merits and demerits of the different types.

In churns there are the Perfection, Disbrow and Simplex. These are all combined churns and butter workers, yet are entirely different in style. In addition, the butter room is equipped with all modern appliances for handling milk and cream, such as cream vats, tempering vats, Wizard and Jensen ripeners, starter cans, and Bohn refrigerator, together with all things necessary for the manufacture of butter in an up-to-date plant. A modern ice cream plant is also installed.

The creamery is equipped with a five-horsepower boiler and a five-horsepower electric motor, and in the practical work each student takes his turn in handling these machines.

The cheese room is 30 by 30 feet, with curing rooms 20 by 20 feet; in the former there are cheese vats, gang and upright presses and all necessary hoops and equipment for the manufacture of all varieties of American Cheddar cheese. In this department there is made both Edam and Brick cheese, but special emphasis is placed on the manufacture of the American cheese.

The testing laboratory is very thoroughly equipped with different styles of Babcock testers (both hand and steam) and all necessary glassware for the testing of milk, cream, butter, cheese, skim milk, whey, etc.

Different tests for the determination of moisture in butter have been added as well as a complete equipment for acidimetry.



## ANIMAL HUSBANDRY.

Professor Flint.

(1) **Animal Types.**—A study of types as related to production and work. This course covers the judging of the different market classes of cattle (beef and dairy), of sheep (mutton and wool), of horses (light and heavy), and of hogs (bacon and fat). The entire time of this course is given to practical handling and judging of the stock in the stock pavillion. Laboratory 3, II, 3.

(2) **Breeds of Live Stock.**—A study of the history, development and characteristics of the leading breeds of live stock, including pedigrees and performances of superior individuals among horses, cattle, sheep and swine. Lectures 4, laboratory 1, I, 5.

(3) **Advanced Stock Judging.**—Judging horses, cattle, sheep and swine with particular reference to breed, character and differences. Practical methods of show yard judging; relation of pure bred stock to market classes. Prerequisite: An. Ind. (1 and 2). Laboratory, 1. I, 1.

(4) **Principles of Feeding.**—The principles underlying the profitable feeding of farm animals. The composition of plants, animals and animal products. The practice that gives best results as indicated by available data gathered from the work of experiment stations in this and other countries. I, 3.

(5) **Market Classes and Grades of Live Stock.**—Includes the judging of the different market classes and grades of live stock. Market classification. Lecture 1, laboratory 1. II, 2.

(6) **Breeding of Farm Animals.**—A study of the principles and approved methods relating to the breeding of live stock. Prerequisite: (An. Ind. 1), (Agr. 7). Lectures, 2. II, 2.

(7) **Swine and Sheep Production.**—A study of practical methods of pork production, including grazing problems, feeding, rearing and marketing. Feeding, care and management of the breeding herd. A study of the feeding, care and management of the breeding flock, rearing for mutton and wool, range problems, and a study of systems of sheep farming. Lectures 3, I, 3.

(8) **Horse and Beef Production.**—A study of the care and management of breeding and growing horses, fitting for show, market classes and their production.

A study of practical methods of beef production, including feeding, care and management of beef cattle herds; fitting for show, feeding for market, and pasture problems. Lectures 3. II, 3.

(9) **Experimental Feeding.**—A study of methods in experimental feeding, and original investigations in feeding horses, cattle, sheep and swine.

Elective: Lectures, 1; laboratory, 1. II, 2.

(10) **Meats.**—Farm butchering, curing and care of meats, yield, quality and values of meat and by-products, as related to breeding, feeding and health of animals. Classes, grades and cuts of meat in markets. Prerequisite: An. Ind., (1). Lectures, 1; laboratory, 1. II, 2.

## DAIRYING.

Assistant Professor Jones.

(21) **Farm Dairying.**—This course comprises a study of the subject of dairying in its general relation to the farm. Milk production, the Babcock test, separation of cream and the care of separators, cream ripening and churning are all discussed in lectures and recitations, and taken up in laboratory. Lectures, 2; laboratory, 1. I, 3.

(22) **Testing Milk and Milk Products.**—The chemical composition of milk and its products in so far as it effects different manufacturing processes is taken up as well as the practical methods for determining the different ingredients. Testing for adulterations and preserving, is also included.

Ref. Books. Testing Milk and its Products by Farrington, Modern Methods of Testing Milk and Milk Products by Van Slyke and Dairy Laboratory Guide by Martin. Prerequisite: Animal Industry (21) and 3 semesters of chemistry. Lecture, 1; laboratory, 1. I, 2.

(23) **Creamery Butter Making.**—This course comprises advanced work in butter making, factory organization, management and accounting and utilization of the by-products in the creamery. Ice cream making is also given prominence in the course. Prerequisite: Animal Industry, (21 and 22). Lecture, 1; laboratory, 2. II, 3.

(24) **Cheese Making.**—The equipment for factory and home cheese making, the principles and practice necessary to make a uniform article and methods used to overcome characteristic difficulties are explained and illustrated in the class room and laboratory. All common varieties of cheese, such as Cheddar, Swiss, Brick and Limburger, are discussed, and as far as possible made in the cheese room, but the Cheddar cheese making is particularly emphasized. Reference books: Cheese Making, by Decker; and the Science and Practice of Cheese Making, by Van Slyke & Publow. Lecture 1, laboratory, 2; II, 3.

(25) **Market Milk.**—The care and handling of milk for city delivery including sanitary certified, modified and hygienic milk. Prerequisite: Animal Industry (21). Lectures, 2; elective, II, 2.

(26) **Scoring Dairy Products.**—A study of market requirements and grading and scoring of milk, cream, butter and cheese. Prerequisite: An. Ind., (21). Elective. Lectures, 2. I, 2.

(27) **Milk Production.**—This course covers dairy husbandry from the standpoint of the producer rather than the manufacturers. It takes up selection and improvement of the dairy herd, herd management and judging the dairy cow. Prerequisite: An. Ind., (21). Lectures, 2; laboratory, 1. II, 3.

## POULTRY HUSBANDRY.

Assistant Professor Schoppe.

(41) **Poultry Management.**—A general course which shall comprise a study of the types and breeds of poultry. The fancy and utility

classification of fowls, principles of breeding, housing, feeding, incubation and brooding. The preparation for, and marketing of poultry products. Lectures, 3; I, 3.

(42) **Poultry Breeds.**—Lecture course dealing with the origin and development of the more important breeds of poultry. Breeding fancy poultry. Preparation of birds for show. Judging by score card and comparison. Lectures, 2; laboratory, 1; II, 3.

(43) **Incubation and Brooding.**—Lecture course on the principles and practice of operating incubators and brooders. Practice in operating incubators, testing eggs, keeping records, etc., also practice in operating brooders, care and feeding of chicks. The laboratory course will have no scheduled hours, but the time will be devoted to actual practice in operating incubators and brooders, each student having to bring off at least one hatch of chicks and satisfactorily brood them. Lectures, 2; laboratory, 1; II, 3.

(44) **Poultry Houses**—A study of the principles of poultry house construction; planning, arranging, and designing poultry houses. Lectures, 3; II, 3.

(45) **Poultry Feeds and Feeding.**—Lectures taking up the principles of feeding poultry. Feeds suited to poultry, grain mixture, etc., feeding for egg production and fattening stock for market. Student will be required to feed a pen of birds and keep accurate records of feed consumed, labor, etc. Lectures, 2; I, 2.

(46) **Marketing Poultry Products.**—Lecture on the preparation of poultry and eggs for market, storage preservation and the principles of marketing, killing, picking, and packing poultry. Drawing, boning, and trussing fowls for special market. Candling, grading and packing eggs. Lectures, 2; laboratory, 1; II, 3.

(47) **Advanced Poultry Breeding.**—Lecture course, in which the more advanced principles involved in breeding birds for show purposes will be considered. A study will also be made of the work which has been done by the various experiment stations in breeding for egg production. The laboratory work will include practice in judging birds, selection and mating of birds for fancy and utility purposes. Prerequisites: Principles of breeding and poultry breeds. Lectures, 2; laboratory, 1; II, 3.

## VETERINARY SCIENCE.

Dr. Welch.

This department does not attempt to offer a full course in veterinary medicine. It gives instruction only in the fundamentals: farm sanitation, prevention of diseases, and a general knowledge of the commoner ailments of domestic animals. The veterinary building is well equipped for such work, having a bacteriological laboratory with sterilizers, incubators, and modern apparatus, and an anatomy laboratory with all facilities for dissection. For demonstration work on

cases brought in for treatment, there is an operating room with equipment for minor operations, and a quarantine ward for detention of cases of tuberculosis, glanders, or other contagious diseases. All class work is illustrated as far as possible with clinic cases.

(51) **Veterinary Physiology.**—A course in animal physiology dealing with the prehension of foods as observed in the various domestic animals. Also the digestion, assimilation and uses of the various foods, the circulation of the blood and its function, the nervous system, the sense of sight and the phenomenon of locomotion. Prerequisite: Biology (3). Text book: A Manual of Veterinary Physiology by Captain F. Smith. II, 4.

(53) **Pathology.**—This course is designed to make the student familiar with the normal and pathological tissues. Gross and microscopical specimens will be used for demonstration. Prerequisite: Biology (3). II, 3.

(54) **Obstetrics.**—Diseases of animals incident to reproduction. Emphasis will be put especially upon normal presentations and reduction of dystokia. Prerequisite: Vet. Sci. (51). Text book: William's Veterinary Obstetrics. II, 3.

(56) **Sanitary Science.**—This course deals with the care and handling of animals affected with communicable diseases. It will also include a few lectures upon sanitary police, or interstate shipment, and on farm sanitation. II, 2.

(57) **Common Diseases of Animals.**—A course on the diagnosis, treatment and prevention of the diseases of domestic animals. Students will be required to visit cases illustrative of these diseases, and to familiarize themselves with method of diagnosis and first aid treatment. Prerequisite: Biology (3). II, 4.

## HORTICULTURE.

Professor Whipple.

Assistant Professor Schermerhorn.

(1) **Principles of Plant Culture.**—A course designed for all students in agriculture and others interested in the subject of plant production. The time is given largely to the study of the principles and practice of plant propagation, including practical work on the propagation of plants by spores, seeds, cuttings, layers, graftage and other methods of lesser importance; methods of gathering and storing seeds and their influence upon germination; transplanting, principles, methods and influence upon the growth of plants. Prerequisite: Biology (9). Lectures, 2; laboratory, 1. II, 3.

(2) **Pomology.**—This course is designed for horticulture students, and deals with the principles and practice of pruning tree-fruits, grapes and small fruits; the physiology of pruning; the fruit bearing habits of plants and their relation to pruning; the effect of ringing, bending and thinning fruit; pruning young trees, dwarf trees and mature trees



—these subjects will be treated in text book, lectures and practice work. Prerequisites: Hort. (1), Biol. (10). II, 3.

(3) **Vegetable Gardening and Small Fruit Culture.**—This course deals with the principles of vegetable gardening and small fruit culture, as well as with the practical side of the subjects. The growing of vegetables in the garden and greenhouse will be discussed. The growing of small fruits adapted to Montana conditions will be taken up in detail. The subjects will be treated in text book, lectures and practice work. Prerequisites: Hort. (1), Biol. (10), Agron. (2). II, 5.

(4) **Systematic Pomology.**—This course takes up the systematic side of pomology, the description and naming of varieties of fruit. Considerable time will also be devoted to the judging of exhibition fruit and discussion of score cards. The latter part of the course will be devoted to a study of the evolution of cultivated plants, especially fruits. Prerequisites: Hort. (1), Biol. (9). Lectures, 2; laboratory, 1. I, 3.

(5) **Greenhouse Construction and Management.**—The construction, heating and maintaining of greenhouses, with lectures and practice treating of the methods of growing plants in greenhouses and conservatories. Prerequisites: Hort. (1), Agron. (2) and (3). I, 3.

(6) **Landscape Gardening.**—The laying out and planting of private and public grounds are discussed. The trees, shrubs and flowers suited to Montana conditions are studied. Lectures, 2; laboratory, 1. II, 3.

(7) **Commercial Fruit Growing.**—In this course the methods of planting, cultivating, irrigating and managing commercial orchards are discussed in the class room and orchard. The methods of picking, grading, packing and marketing fruits are important phases of the course. Prerequisites: Hort. (1), (2) and (4), Agron. (2) and (3). Lectures, 2; laboratory, 1. I, 3.

(8) **Thesis.**—Horticultural students may elect to prepare during the senior year a thesis, the subject of which must be approved by the head of the department of horticulture. The number of credits to be allowed for such work will be determined by the head of the horticultural department and the instructor under whom the work is selected.

(9) **Home Floriculture.**—An elective course open to senior and junior girls only. A brief study of the simple principles of plant propagation by seedage, cuttage and layerage, selection, identification, and general care of house plants. Window gardening, window boxes, hanging baskets and porch decorations in general. The use and care of flowers on the lawn, the simple principles of dooryard planting, and suggestions on ornamental plants. Lectures, 2. II, 2.



# College of Engineering

Arthur W. Richter, Dean.

The rapid development of the State of Montana makes the profession of engineering one of great importance. The development of our natural resources will require the services of engineers with specialized training.

As a result of the action of the State Board of Education, made necessary by the passage of the Leighton Bill, all engineering courses supported by the state, except the course in mining engineering at the School of Mines at Butte, have been concentrated in the State College at Bozeman. As a result of this concentration of effort, important additions and improvements have been made during the present year, very important additional laboratory space has been provided and extensive and important additions have been made to the equipment, largely without cost to the state.

## COURSES AND DEGREES.

The following engineering courses are offered in the College: Civil Engineering, Electrical Engineering, Mechanical Engineering, Chemical Engineering, Architectural Engineering, and Irrigation Engineering.

The degree of Bachelor of Science is conferred upon students completing the work prescribed in any one of the college courses and the name of the course taken is placed on the diploma.

A candidate for the advanced degree of Civil Engineer, of Electrical Engineer, of Mechanical Engineer, of Chemical Engineer, of Architectural Engineer or of Irrigation Engineer, must hold a bachelor's degree from this college or another of at least equal rank, and in the line of work for which he applies for advanced degree, he shall have sufficient preparation in his major subject to enable him to carry on independent investigations. He shall complete a full year of resident study.

There shall be one major subject and one or two minor subjects. At least one-half of the work must be done in the major subject. The plan of the work must be approved by the Faculty Committee on Graduate Work by October 1. The candidate shall also present a thesis embodying the results of independent investigation, which may be a part of the credits required for the major subject. He shall also pass an oral examination on his graduate work before a committee of not less than five members representing the departments offering his major and minor subjects and two or more allied departments. Non-resident graduates in engineering must have at least three years of successful professional experience.

## FACILITIES FOR INSTRUCTION.

In addition to the room now occupied by the several departments, additional laboratory space is being provided and new equipment is being installed.

A new laboratory, forty-three by one hundred and forty-two feet, and a two story structure, forty by fifty feet, are nearing completion and will be ready for occupancy at the opening of the school year. In the two-story structure additional class rooms and offices will be provided. There is also a periodical reading room which will contain about thirty-five periodicals for the use of students.

There are civil, electrical, and mechanical laboratories. In the civil engineering laboratories will be found a very complete equipment of surveying instruments, current meters, etc. There is a cement laboratory for making tests of cements, and a materials laboratory for the testing of materials of construction. There are also electrical laboratories for the testing of electrical machinery and appliances. The mechanical laboratories are equipped for a study of steam and gas engines, boilers, power stations and power station fuels, compressed air, etc. The machine shops give ample facilities for instruction in wood and metal work.

The instruction given in the above laboratories is closely related to the work given in the class room and consequently prepares the student to solve more readily the problems met with in the practice of his profession.

## Civil Engineering

This course is designed to prepare the student to practice the profession of civil engineering in the following branches: Structural engineering; street, highway, and railway engineering; water supply engineering; city engineering; sanitary engineering; river and harbor improvement; plotting, mapping, surveying, reports, estimates, etc. The technical subjects that give proficiency in the above named branches are supplemented by a thorough study of capital, labor, banking, cost and cost keeping, contracts, specifications, and other legal phases of engineering. An exceedingly profitable and varied field is thus opened to the graduate.

Each student is expected to engage in practical engineering work during his summer vacations, and he is assisted in securing such positions as he may be able to fill.

## CIVIL ENGINEERING.

### FRESHMAN YEAR.

#### First Semester.

English Composition (Eng. 1).	2
Public Speaking (Eng. 4).....	1
Algebra (Math. 1).....	3
Trigonometry (Math. 2).....	2
General Chemistry (Chem. 1) ..	4
Elementary Drawing (M. E. 1)	3
Forge Work (M. E. 6).....	3
Military Drill .....	1

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19

#### Second Semester.

English Composition (Eng. 1)	2
Public Speaking (Eng. 4)....	1
Analytic Geometry (Math. 3) ..	4
Descriptive Geometry (M.E. 3)	4
General Chemistry (Chem. 1)	4
Plane Surveying (C. E. 1)....	3
Military Drill .....	1

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19

### SOPHOMORE YEAR.

English Composition (Eng. 2).	2
Calculus (Math 4).....	5
General Physics (Phys. 1).....	3
Physical Measurements (Phys. 2)	2
Plane Surveying (C. E. 1).....	3
*Highway Construction (C.E. 7)	2
Military Drill....	1

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18

Calculus (Math. 4).....	5
Electrical Machinery (E.E. 1)	2
General Physics (Phys. 1)....	3
Physical Measurements (Phys. 2)	2
*Railroad Engineering (C. E. 4)	6
Military Drill.....	1

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19

### JUNIOR YEAR.

Mechanics (C. E. 5).....	4
Hydraulics (I. E. 4).....	3
Irr. Engineering (I. E. 1).....	3
Graphics (C. E. 28).....	2
*Field Practice (C. E. 11)....	4
*Cost of Construction (C.E. 25)	2
Seminar (C. E. 12).....	1

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19

Mechanics (C. E. 5).....	4
Strength of Materials (M.E. 14)	1
*Least Squares (Math. 5)....	2
Bridge Analysis (C. E. 29)....	3
Sanitary Engineering (C.E. 14)	3
Contract and Spec. (C. E. 23) ..	1
*Geology (Geol. 1).....	3
Seminar (C. E. 12).....	1

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18

### SENIOR YEAR.

Economics (Econ. 3).....	2
Hydraulic Engineering (I.E. 5)	3
Engineering Design (C. E. 19)	3
Found. and Masonry (C.E. 21)	3
*Astronomy (Math. 6).....	3
*Geodesy (C. E. 17) .....	3
Seminar (C. E. 12).....	1
Thesis (C. E. 27).....	1

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19

Economics (Econ. 3).....	2
Municipal Engineering (C.E. 3)	3
Engineering Design (C. E. 19)	3
*Practical Astronomy (C.E. 24)	2
*Concrete Construction (C.E. 32)	3
Seminar (C. E. 12).....	1
Thesis (C. E. 27).....	5

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19

\*Students specializing in Sanitary Engineering must take Biology (9) and (10), Chemistry (2), the first semester of Chemistry (3), Chemistry (10), and Architectural Engineering (5), as a substitute for an equal number of credits in subjects marked with \*

## Electrical Engineering

This course provides a thorough technical training in electrical engineering. The rapid development of electrical engineering is largely due to the use of sound theory in the solution of commercial problems. For this reason the theoretical subjects, and the application of theory to the solution of practical problems are emphasized.

The course is designed to teach students the scientific laws and principles forming the basis of the profession, and the application of these laws and principles to commercial problems. The general training consists of courses in mathematics, physics, chemistry, drawing, and shop work. The electro-technical work consists of lectures and recitations on the theory of electrical phenomena, and on problems in the design, construction and operation of electrical machines and apparatus. Conventional methods are used in drawing and designing, and the experimental tests made in the laboratory are essentially similar to the tests made by large manufacturing companies. The apparatus and instruments used are of modern commercial types.

The course is supplemented by an annual inspection trip to some of the large power plants of Montana, and by lectures by prominent electrical engineers.



### ELECTRICAL ENGINEERING. FRESHMAN YEAR.

#### First Semester.

English Composition (Eng. 1).	2
Public Speaking (Eng. 4).....	1
Algebra (Math. 1).....	3
Trigonometry (Math. 2).....	2
General Chemistry (Chem. 1).	4
Elementary Drawing (M. E. 1)	3
Forge Work (M. E. 6).....	3
Military Drill .....	1

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19

#### Second Semester.

English Composition (Eng. 1).	2
Public Speaking (Eng. 4).....	1
Analytic Geometry (Math. 3)..	4
Descriptive Geometry (M. E. 3)	4
General Chemistry (Chem. 1).	4
Foundry (M. E. 4).....	1
Woodwork (M. E. 2).....	2
Military Drill .....	1

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19

### SOPHOMORE YEAR.

Expository Composition (Eng. 2)	2
Calculus (Math. 4).....	5
General Physics (Phys. 1)....	3
Physical Measurements (Phys. 2)	2
Plane Surveying (C. E. 1a)....	3
Pattern Work (M. E. 2a).....	2
Foundry (M. E. 4a).....	1
Military Drill.....	1

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19

Calculus (Math. 4).....	5
General Physics (Phys. 1)....	3
Physical Measurements (Phys. 2)	2
Electrical Machinery (E. E. 1)	2
Dynamo Drawing (E. E. 2)....	2
Machine Work (M. E. 17)....	2
Elective .....	2
Military Drill .....	1

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19

### JUNIOR YEAR.

Mechanics (C. E. 5).....	4
Dynamos and Motors (M. E. 3)	3
Electricity and Mag. (Phys. 5)	4
Electrical Diagrams (E. E. 7)	2
Electrical Laboratory (E. E. 4)	2
Seminar (E. E. 17).....	1
Steam Engineering (M. E. 7)..<	2
Power Plant Practice (M. E. 16)	1

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19

Mechanics (C. E. 5).....	4
Applied Electricity (E. E. 5)..<	4
Dynamo Design (E. E. 8)....	3
Strength of Materials (M. E. 14)	1
Electrical Laboratory (E. E. 6)	2
Seminar (E. E. 17).....	1
Heat Power (M. E. 18a).....	2
Mechanical Lab. (M. E. 15a)	2

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19

### SENIOR YEAR.

Economics (Econ. 3).....	2
Alternating Currents (E. E. 9)	4
Electrical Design (E. E. 13)..<	3
Electrical Lab. (E. E. 10)....	3
Seminar (E. E. 17).....	1
Thesis (E. E. 20).....	2
Elective.....	2 or 3

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17 or 18

Economics (Econ. 3).....	2
Alternating Currents (E. E. 11)	4
Electrical Design (E. E. 16)....	3
Contracts and Specifications (C. E. 23) .....	1
Electrical Laboratory (E. E. 12)	2
Seminar (E. E. 17).....	1
Thesis (E. E. 20).....	3
Elective .....	2 or 3

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18 or 19

## Mechanical Engineering

The purpose of the course in mechanical engineering is to fit its graduates for successfully filling responsible positions as supervising and designing engineers. It furnishes fundamental training in the science, the art and the business of engineering, and prepares for the design, operation, superintendence and management of power plants, heating plants, refrigerating plants, lighting plants, pumping plants, and of the mechanical equipment of mines and railroads; and for the design, manufacture, installation, testing and operation of shop and laboratory machinery, steam and gas engines, and auxiliary equipment.

The course comprises four years' instruction and training by text book, lecture, laboratory and shop practice, based on mathematics, physics, chemistry, mechanics, machine design, structural design and thermodynamics. It is designed to give the student a thorough knowledge of the basic principles of his profession and such technical skill as the application of theoretical principles in every day practice in shop and laboratory will insure. The work of each department—class room, laboratory, shop and designing room—is made to supplement the work of each of the others, so that the graduate beginning his profession has not only a valuable fund of scientific knowledge, but a first hand acquaintance with sound practice, developed under the supervision of trained men—a balance in his technical equipment attainable in no better way.

## MECHANICAL ENGINEERING.

### FRESHMAN YEAR.

First Semester.	Second Semester.
English Composition (Eng. 1) 2	English Composition (Eng. 1) 2
Public Speaking (Eng. 4).... 1	Public Speaking (Eng. 4)..... 1
Algebra (Math. 1)..... 3	Analytic Geometry (Math. 3).. 4
Trigonometry (Math. 2)..... 2	Descriptive Geometry (M. E. 3) 4
General Chemistry (Chem. 1). 4	General Chemistry (Chem. 1) 4
Elementary Drawing (M. E. 1) 3	Foundry (M. E. 4)..... 1
Forge Work (M. E. 6)..... 3	Wookwork (M. E. 2)..... 2
Military Drill..... 1	Military Drill..... 1
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19	19

### SOPHOMORE YEAR.

Expository Composition(Eng.2) 2	Calculus (Math. 4)..... 6
Calculus (Math. 4)..... 5	General Physics (Phys. 1).... 3
General Physics (Phys. 1).... 3	Physical Measurements(Phys.2) 2
Physical Measurements(Phys.2) 2	Electrical Machinery (E. E. 1) 2
Mechanism (M. E. 5)..... 4	Mechanism (M. E. 8)..... 4
Pattern Work (M. E. 2a)..... 2	Machine Work (M. E. 17).... 2
Foundry (M. E. 4a)..... 1	Military Drill..... 1
Military Drill..... 1	
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20	19

### JUNIOR YEAR.

Mechanics (C. E. 5)..... 4	Mechanics (C. E. 5)..... 4
Steam Engineering (M. E. 7).. 2	Thermodynamics (M. E.18)... 4
Valve Gears (M. E. 10)..... 2	Machine Design (M. E. 13)... 6
Electricity and Magnetism (Phys. 5) .... 4	Mechanical Laboratory (M.E. 15a).... 2
Hydraulics (I. E. 4)..... 3	Strength of Materials (M.E.14) 1
Machine Work (M. E. 21).... 2	Machine-Tool Work (M. E. 27) 2
Power Plant Practice (M.E.16) 2	
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19	19

### SENIOR YEAR.

Economics (Econ. 3)..... 2	Economics (Econ. 3)..... 2
Gas Engineering (M. E. 22)... 3	Steam Engineering (M.E. 26).. 2
Engine Design (M. E. 23).... 4	Plant Design (M.E. 29)..... 3
Heating and Ventilation (M. E. 24) .... 2	Engineering Lab. (M. E. 28)... 2
Steam and Gas Laboratory (M. E. 20) ..... 2	Industrial Engineering (M. E. 25) ..... 2
Electric Power (E. E. 14).... 3	Seminar (M. E. 11)..... 1
Electrical Laboratory (E.E.14a) 2	Machine Design (M. E. 31)... 2
Seminar (M. E. 11)..... 1	Contracts and Specifications (C. E. 23)..... 1
	Thesis (M. E. 30)..... 4
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19	19

## Chemical Engineering

This course provides for a thorough training in chemical engineering and deals with the application of chemistry and electro-chemistry to manufacture.

In the first two years the student is taught mathematics, English, drawing, general chemistry, physics, etc. These are followed in the junior and senior years by a thorough course in industrial processes, given by lectures, supplemented by laboratory instruction.

The work includes a thorough study of the manufacture of such materials as cements, glass, fertilizers, explosives, alkalies, acids, paints, sugar, paper, etc.

Special attention is given to heat and its application to industrial processes.

Attention is given to the manufacture of gases and the by-products of gas works.

The above work is supplemented by courses in electrical engineering, steam engineering, etc.

Inspection trips are taken to some of the larger industrial plants of Montana in order that the student may examine the work as actually done in manufacturing plants.

## CHEMICAL ENGINEERING.

### FRESHMAN YEAR.

#### First Semester.

English Composition (Eng. 1)	2
Public Speaking (Eng. 4).....	1
Algebra (Math. 1).....	3
Trigonometry (Math. 2).....	2
General Chemistry (Chem. 1) ..	4
Elementary Drawing (M. E. 1)	3
Forge Work (M. E. 6).....	3
Military Drill.....	1

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19

#### Second Semester.

English Composition (Eng. 1)	2
Public Speaking (Eng. 4).....	1
Analytic Geometry (Math. 3) ..	4
Descriptive Geometry (M. E. 3)	4
General Chemistry (Chem. 1) ..	4
Foundry (M. E. 4).....	1
Woodwork (M. E. 2).....	2
Military Drill.....	1

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19

### SOPHOMORE YEAR.

Calculus (Math. 4).....	5
General Physics (Phys. 1)....	3
Physical Measurements (Phys. 2)	2
Qualitative Analysis (Chem. 2)	4
Mechanism (M. E. 5).....	4
Military Drill.....	1

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19

Calculus (Math. 4).....	5
General Physics (Phys. 1)....	3
Physical Measurements (Phys. 2)	2
Organic Chemistry (Chem. 5) ..	5
Electric Machinery (E. E. 1) ..	2
Military Drill.....	1

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18

### JUNIOR YEAR.

Mechanics (C. E. 5).....	4
Quantitative Analysis (Chem. 3)	5
Mineralogy (Geol. 2).....	4
Electricity and Magnetism (Phys. 5) .....	4
Steam Engineering (M. E. 7) ..	2

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19

Mechanics (C. E. 5).....	4
Sound and Light (Phys. 3 and 4) .....	4
Strength of Materials (M. E. 14).....	1
Heat Power Engineering (M. E. 18) .....	4
Chemical Factory Machinery (Chem. 13).....	3
Quantitative Analysis (Chem. 3)	2

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18

### SENIOR YEAR.

Electric Power (E. E. 14).....	3
Economics (Econ. 3).....	2
Industrial Chemistry (Chem. 14)	5
Mechanical Laboratory (M. E. 15a) .....	2
Physical Chemistry (Chem. 19)	2
Seminar (20) .....	1
Elective .....	1
Thesis .....	1

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17

Economics (Econ. 3).....	2
Contracts and Specifications (C. E. 23) .....	1
Industrial Chemistry (Chem. 14).....	2
Mechanical Laboratory (M. E. 20).....	2
Fuel Analysis (Chem. 17)....	3
Seminar (20).....	1
Elective....	4
Thesis .....	3

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18



## Architectural Engineering

The rapid increase of population in the State of Montana will result in a healthy growth of our cities and towns. Homes, factories, office buildings and public buildings will be erected.

In addition to the sciences which are common to all engineering courses, this course includes a thorough study of free hand drawing and the drawing of architectural designs. Ancient and modern architecture is studied in all its phases in order that the student may become acquainted with proper architectural forms. The construction of steel and concrete buildings, the sanitation of buildings, the interior and exterior decoration, and illumination, form an important part of the instruction given in this course. The graduates are consequently well prepared to enter the profession of architectural engineering.

# ARCHITECTURAL ENGINEERING.

## FRESHMAN YEAR.

### First Semester.

English Composition (Eng. 1) .	2
Public Speaking (Eng. 4).....	1
Algebra (Math. 1).....	3
Trigonometry (Math. 2).....	2
General Chemistry (Chem. 1) .	4
Elementary Drawing (M. E. 1) 3	
Forge Work (M. E. 6).....	3
Military Drill .....	1

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19

### Second Semester.

English Composition (Eng. 1) .	2
Public Speaking (Eng. 4).....	1
Analytic Geometry (Math. 3)..	4
Descriptive Geometry(Math. 3)	4
General Chemistry (Chem. 1) .	4
Freehand Drawing (A. E. 1)..	3
Military Drill .....	1

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19

## SOPHOMORE YEAR.

English Composition (Eng. 2) .	2
Calculus (Math. 4).....	5
Physics (Phys. 1).....	3
Physical Measurements(Phys.2)	2
Freehand Drawing (A. E. 1)..	2
Working Drawings (A. E. 2)..	3
Elective ....	1

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18

Calculus (Math. 4).....	5
Physics (Phys. 1).....	3
Physical Measurements(Phys.2)	2
History of Architecture (A. E. 3).....	3
Elementary Design (A. E. 4)..	3
Building Sanitation (A. E. 5)..	2
Military Drill .....	1

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19

## JUNIOR YEAR.

Mechanics (C. E. 5).....	4
Hydraulics (I. E. 4).....	3
Graphics (C. E. 28).....	2
Economics (Econ. 3).....	2
History of Architecture (A.E.3)	3
Estimating (A. E. 7).....	1
Steam Engineering (M. E. 7)..	2
Elective ....	2

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19

Mechanics (C. E. 5).....	4
Strength of Materials(M.E.14)	2
Bridge Analysis (C. E. 29)....	3
Contracts and Specifications (C. E. 23).....	2
Specifications and Working Drawings (A. E. 6).....	3
History of Architecture(A.E. 3)	3
Economics (Econ.3).....	2

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19

## SENIOR YEAR.

Heat. and Ventilating(M. E.24)	2
Architectural Engineering (A. E. 8).....	3
Bridge Design (C. E. 30).....	3
Foundations and Masonry (C. E. 21).....	3
Electric Power (E. E. 14)....	3
Seminar (A. E. 9).....	1
Elective .....	2
Thesis....	2

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19

Architectural Engineering(A.E. 8).....	3
Bridge Design (C. E. 31).....	3
Illumination (E. E. 19).....	2
Architectural Decoration (A. E. 10).....	2
Seminar (A. E. 9).....	1
Elective.....	4
Thesis.....	4

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19

## Irrigation Engineering

The course in irrigation engineering will meet the needs of those who wish to become proficient in the construction, operation and maintenance of irrigation systems.

Following the freshman and sophomore years, there are courses in irrigation engineering dealing with the principles of irrigation, the location of irrigation systems, the manner of supplying, storing, conveying and distributing irrigation water.

Special attention is also given to hydraulic engineering, as it is important that a student in this course should be thoroughly familiar with rainfall, drainage area, and water power development. These courses include thorough laboratory work.

In order that the student may become thoroughly acquainted with the subject, the courses in irrigation engineering are supplemented by such courses in agriculture as are necessary to understand the purposes for which water is used on the farm and the general management of irrigated lands, as for example; field crops, soil physics, and farm management.

### IRRIGATION ENGINEERING. FRESHMAN YEAR.

First Semester.		Second Semester.	
English Composition (Eng. 1). 2		English Composition (Eng. 1). 2	
Public Speaking (Eng. 4).... 1		Public Speaking (Eng. 4)..... 1	
Algebra (Math. 1)..... 3		Analytic Geometry (Math. 3).. 4	
Trigonometry (Math. 2)..... 2		Descriptive Geometry (M. E. 3) 4	
General Chemistry (Chem. 1).. 4		General Chemistry (Chem. 1). 4	
Elementary Drawing (M. E. 1) 3		Plane Surveying (C. E. 1)... 3	
Forge Work (M. E. 6)..... 3		Military Drill ..... 1	
Military Drill.... .. 1			
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19		19	

### SOPHOMORE YEAR.

Calculus (Math. 4)..... 5		Calculus (Math. 4)..... 5	
General Physics (Phys. 1)... 3		General Physics (Phys. 1)... 3	
Physical Measurements (Phys. 2) 2		Physical Measurements (Phys. 2) 2	
General Botany (Biol. 9)..... 5		Canal Surveying (C. E. 2)..... 3	
Plane Surveying (C. E. 1)... 3		Field Crops (Agron. 1)..... 5	
Military Drill.... .. 1		Military Drill..... 1	
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19		19	

### JUNIOR YEAR.

Irrigation Engineering (I. E. 1) 3		Irrigation Engineering (I. E. 2) 3	
Mechanics (C. E. 5)..... 4		Mechanics (C. E. 5)..... 4	
Graphics (C. E. 28)..... 2		Strength of Materials (M. E. 14) 2	
Hydraulics (I. E. 4)..... 3		Contracts and Specifications	
Soil Physics (Agron. 2)..... 5		(C. E. 23) ..... 2	
Elective..... 2		Hydraulic Laboratory (I. E. 6) 2	
		Elective.... .. 6	
—		—	
19		19	

### SENIOR YEAR.

Hydraulic Engineering (I. E. 5) 3		Canal Management (I. E. 3).. 3	
Electric Power (E. E. 14)... 3		Mechanical Laboratory (M. E.	
Heat Power Steam Engineering		15a).... .. 2	
(M. E. 7)..... 2		Economics (Econ. 3)..... 2	
Foundations and Masonry (C.		Seminar (I. E. 8)..... 1	
E. 21)..... 3		Thesis..... 5	
Farm Management (Agron. 6) 4		Elective..... 6	
Economics (Econ. 3) ..... 2			
Electrical Laboratory (E. E.			
14a).... .. 2			
—		—	
19		19	

Students in Irrigation Engineering will be required to spend one summer vacation working on a farm.

**CIVIL ENGINEERING.**

Professor Kneale.

Assistant Professor Plew.

Assistant Professor Snow.

The equipment of this department consists of transits, solar attachments, precision levels, hand levels, engineers' wye and dumpy levels, plane tables, alidades, declinators, tachymeters, theodolite, sextant and horizon, reflectoscope and lantern, aneroids, engineers' compass, current meters, tide gauge, automatic water registers, model flumes, etc., odometer, vicat needle, Gilmore needles, bricquette machines and molds, weir measuring devices, specific gravity apparatus, fineness scales, polar and rolling planimeters, level and stadia rods, chains, tapes, drafting instruments, blue printing apparatus, complete photographic outfit, complete laboratory and drafting rooms well supplied with necessary equipment.

The department is quartered in eight rooms which include drafting rooms, seminar room, photographic dark room, cement laboratories, office, instrument room and lecture room.

(1) **Plane Surveying.**—The theory and practice of plane surveying, including the elementary principles, the use and adjustment of field and office instruments, the methods of field, hydrographic, mine and city surveying; barometric and spirit leveling, and the computation of earth work. Prerequisites: Mathematics up to and including trigonometry. Texts: Theory and Practice of Surveying, by Johnston; Manual of Surveying, by Pence & Ketchum. Lectures, 3; laboratory, 3. I, 3; II, 3.

(1a) **Surveying.**—This course includes the theory, adjustment, and use of instruments in land surveying, in hydrography, in water measurement, in irrigation and drainage, in plotting and mapping, and in draughting and office work. Text: Johnson's Theory and Practice of Surveying. Prerequisite: Math. (2). Lectures, 1; laboratory, 2. I, 3.

(3) **Municipal Engineering.**—This course is given to cover such problems of city engineering as are not studied in the course in sanitary engineering. Particular attention is given to city planning; allotting and platting additions; disposal of refuse; construction of streets, sidewalks, surbs, and gutters; to parks and parkings; and to the law affecting the work of the city engineer. Prerequisites: C. E. (1), (2), and (4). Text: Baker's Roads & Pavements. Lectures, 3. II, 3.

(4) **Railroad Engineering.**—Railroad reconnoissance, preliminary and location surveys. Theory and practice in laying out railroad structures, simple and compound curves, easements and transition spirals, simple and compensated grades, switches, turnouts and crossings. The making and use of mass diagrams, profiles, field maps, cross sections, etc. Calculations of yardage in embankments, excavations and borrow pits. Complete map of location survey for short line of railroad. Prerequisite: C. E. (1). Texts: Searle's Field Engineering. Webb's Railroad Construction. Lectures, 4; laboratory, 2. II. 6.



(5) **Mechanics.**—Forces and equivalence of force systems, center of gravity and centroids, attraction, stress, strain, principle of equilibrium, rectilinear and curvilinear motion, translation, work and energy, impulse, impact, momentum, second moments, vectors, materials of engineering and testing machines, elastic and ultimate deformation, theory of beams, columns and shafts, apparent and combined stresses, resilience, fatigue, least work, true internal stresses, riveting and friction. Texts: Maurer's Technical Mechanics, and Merriman's Mechanics of Materials. Lectures, 4. I and II, 8.

(7) **Highway Engineering.**—Location, construction, and maintenance of highways. Water, salts, emulsions, tars, and bitumens as binders and dust preventatives. Tests of highway materials. Traffic data in relation to type of road. Methods of drainage, including types of culverts and area of water way. Patented types. Federal, state, and county aid. Highway laws. A study of traction, sanitation, radiation of light and heat, slipperiness, ease of cleaning, repairing, etc. Text: Byrne's Highway Construction. Lectures, 2. I, 2.

(11) **Field Practice.**—Practice in the use of engineering instruments on the more difficult problems of civil engineering. The work is designed to develop speed and accuracy. Photography is applied to making surveys and reports. Prerequisites: C. E. (1) and (4), and Chem. (1). Laboratory, 4. I, 4.

(12) **Seminar.**—The junior and the senior students and the instructors of the department meet once a week to discuss the more important problems of the engineering profession. At the beginning of the semester the names of the students are placed in order for the year's work, and the work is assigned in the following sequence: Speaker, chairman, secretary. The speaker delivers a thirty minute lecture on some engineering topic selected with the advice of an instructor. The lecture is followed by a general discussion of the subject. The secretary reports an abstract of the meeting at the next session, and the chairman presides and conducts the seminar according to the best parliamentary procedure. Extemporaneous speeches on engineering topics are required as tests. By means of the reflectroscope the student is enabled to illustrate his lectures. Lectures, 1. I and II, 2.

(14) **Sanitary Engineering.**—Collection, purification and distribution of water; systems of water supply and sewerage; disposal of sewage; house drainage; sanitary inspection. Text: Folwell's Sewerage, and Turneaure & Russell's Water Supplies. Prerequisites: C. E. (4, 5, 6), (8 and 9). Lectures, 3. II, 3.

(17) **Geodesy.**—Elements of geodesy. Base line measurements, triangulation, balancing surveys and distributing errors, application of method of least squares, principles of map projections, tests and investigations. Text: Johnson's Theory and Practice of Plane Surveying. Lectures, 1; laboratory, 2. I, 3.

(19) **Engineering Design.**—This course is devoted to the design of engineering works, maps, etc. Laboratory, 3. I, II, 6.

(21) **Foundations and Masonry.**—This course includes a study of materials and methods employed in the construction of piers, abutments, masonry dams, retaining walls and foundations; economy of construction; strength of joined materials; composition of different kinds of mortar. Text: Baker's Foundations and Masonry. Lectures, 3. I, 3.

(23) **Contracts and Specifications.**—The elementary law of contracts and its application to engineering considered, together with the correct form of specifications and the judicial interpretation placed on the technical terms commonly used in engineering specifications. Text: Johnson's Contracts and Specifications. Elective to all engineering students after the sophomore year. Lectures, 2. II, 2.

(24) **Practical Astronomy.**—A course in astronomy designed to meet the needs of the civil engineer. A considerable portion of the time is given to day and night astronomical observations. Text: Comstock's Field Astronomy. Prerequisite: Mathematics (6). Laboratory, 2. II, 2.

(25) **Cost of Construction.**—This course is designed to acquaint the student with the cost of labor and materials used in engineering construction; to point out the necessity and methods of keeping accurate records of the cost of proposed engineering surveys, and construction work. Text: Gillette's Cost Data. Prerequisites: C. E. (1, 1a, 4, 5, 8), (13). Lectures, 2. I, 2.

(27) **Thesis.**—The student will be required before graduation to present a suitable thesis upon some engineering subject in the line of his course. A copy of the same, together with all original maps, tables, etc., typewritten, bound, and upon specified paper, will be filed with the college and become its property. The student is required to select his subject at the beginning of the senior year. II, 5.

(28) **Graphics.**—The graphical determination of the stresses in roof trusses and other simple structures, and a detailed design of a roof truss in wood and one in steel. Laboratory 2. I, 2.

(29) **Bridge Analysis.**—The analysis of the stresses in bridges due to uniform and wheel loads; action of counters; portal bracing; influence lines; combination of stresses; impact. Laboratory 3. II, 3.

(30) **Bridge Design.**—The design of a plate girder railway bridge complete with shop drawings. Laboratory 3. I, 3.

(31) **Bridge Design.**—The design of a pin connected Pratt truss railway bridge, and a riveted Pratt highway bridge, the latter complete with shop drawings. Laboratory 3. II, 3.

(32) **Concrete Construction.**—Advanced concrete design, together with a study of surfaces, waterproofing, concrete and cement machinery, etc. Prerequisite: The first semester of C. E. (5). Lectures, 1; laboratory 2. II, 3.

(33) **Canal Surveying.** The theory and practice of canal surveying; computation of earth work, and field location of canals for irrigation. Laboratory, 2. II, 2.

## ELECTRICAL ENGINEERING.

Professor Thaler.

Mr. Haines.

The electrical engineering department occupies a two story stone building and the second floor of a frame building. The electrical laboratory is located on the first floor. The second floor contains class rooms and drafting rooms, a photometer room, a battery room, and a high tension room.

The equipment of the electrical laboratory is very complete, with apparatus of modern type. There are two double current multipolar generators, capacity 15 K. W. These machines may be driven by the 40 H. P. engine or by the laboratory motor, and may be used as direct current dynamos, as alternators, single, two or three phase; as synchronous motors or as rotary converters.

The two machines are also used for practice in synchronizing, and furnish alternating current for the induction motors, and for the mercury arc rectifier. For direct current work the laboratory contains in addition to the two generators, one Excelsior 15 light arc dynamo, connected to eight series-arc-lamps, arranged for testing purposes; one 15 H. P. Northern Electric company motor; and one 10 H. P. Siemens and Halske motor. Each motor is provided with a friction brake and other auxiliary apparatus for complete tests of the armature and field resistance, of the magnetic distribution and leakage, and of the efficiency and regulation at different loads; one 6 K. W. Excelsior dynamo may be used as either a shunt or a compound machine, and is driven by the 10 H. P. motor and arranged for testing purposes.

For alternating current work the laboratory contains, in addition to the two generators, one mercury arc rectifier, capacity 30 amperes at 110 volts; one 2 H. P. single phase Westinghouse induction motor with phase splitter, provided with a prony friction brake for efficiency and regulation tests at different frequencies and at different voltage; one 6 H. P. three phase General Electric Company induction motor, also provided with auxiliary apparatus for testing purposes.

A 150,000 volt testing transformer is used to test insulators for high tension transmission, and to test the insulation resistance of insulating materials.

Seven transformers, six single phase and one three phase, capacities from 1 to  $1\frac{1}{2}$  K. W., are available for testing purposes, and for practice in making transformer connections.

A General Electric Company oscillograph with photometric and tracing table attachments, is provided for investigating the wave forms of alternating and oscillatory electro-motive forces and currents.

For general testing the laboratory contains one stationary lamp bank of 136 incandescent lamps, with a current capacity of 130 amperes at 110 volts; the lamps are arranged so that the current can be regu-

lated within a small fraction of one ampere; four portable lamp banks of ten lamps each, arranged so that the lamps can be connected either in series or in parallel; one 900 Ohm iron wire resistance and five iron wire resistances for heavy currents, besides a number of rheostats, switches and current breakers.

The laboratory contains twenty-nine electrical measuring instruments, including nine voltmeters; one Whitney 150-330 volts; one Whitney 15 volts; one Weston 150 volts; one Weston milli-meter; one Weston 75-150 volt A. C.; one Westinghouse 150 volt switchboard voltmeter.

There are eight portable ammeters; one 5 ampere D. C. Weston, three Whitney ammeters, capacity 10, 25 and 50 amperes, D. C., respectively; two Hoyt's A. C. ammeters, 10 and 30 amperes respectively; one G. E. ammeter with series transformer, 120 amperes A. C., and one Westinghouse, 120 amperes.

The department has four portable wattmeters; one Westinghouse, with series transformer, capacity 100 amperes at 200 volts; one Hoyt, capacity 1,500 K. W., one Weston, with multiplier, 2 amperes at 2,250 volts; one G. E. Co. wattmeter, capacity 10,000 watts.

The apparatus for calibrating instruments consist of one Leeds potentiometer with standard cell and standard resistance, one Kelvin standard watt balance, one Westinghouse precision voltmeter and one Westinghouse precision wattmeter.

One mercury vapor lamp, 15 arc lamps, series, constant potential, alternating and direct current, Tungsten, Tantalum and Nernst lamps are available for testing purposes.

In the photometer room is a Willyoung station photometer with universal rotator and bunsen screen for testing the candle power, distribution of light, and the efficiency of incandescent lamps.

The battery room contains a storage battery of 56 cells at 60 ampere hours capacity, of the following types: 10 chloride accumulators, 10 National Battery Company's unit accumulator, 10 Willard cells and 26 American cells. The batteries furnish current for calibrating instruments and are also available for testing purposes.

A 15 K. W. wireless telegraph station will be ready for use at beginning of the college year.

Before beginning work a student must provide himself with one of the following sets of drawing instruments or a set of equal quality: K. & E. No. 896 NCP with No. 523½ pen, or Dietzgen No. 937 C with No. 508 pen.

(1) **Electrical Machinery.**—Lectures on the construction, care and operation of commercial electrical machines and apparatus, including batteries, electric lights, dynamos, motors, alternators, transformers and electrical measuring instruments. Text: Introduction to Electrical Engineering, by H. H. Norris. Lectures, 2. II, 2.

(2) **Dynamo Drawing.**—Detail working drawing, tracing, and blue printing of electrical machines in the laboratory, to familiarize the stu-



dent with the conventional methods of representing the different parts of dynamos and motors. Laboratory, 2. II, 2.

(3) **Dynamos and Motors.**—Principles of electro-magnetism, theory of dynamo electric machines, the design, construction and regulation of direct current dynamos and motors. Prerequisites: Physics (1) and calculus. Textbook: Elements of Electrical Engineering, by Franklin and Esty. Lectures, 3. I, 3.

(4) **Electrical Laboratory.**—Laboratory tests to determine armature and field resistance, magnetic leakage coefficients, characteristic curves and the efficiency and regulation of various types of direct current machines. Prerequisites: Physics (2) and (6). Textbook: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. I, 2.

(5) **Applied Electricity.**—Methods and calculations of wiring, theory of primary cells and storage batteries, and electric light. Text book: Elements of Electrical Engineering, by Franklin & Esty. Lectures, 4. II, 4.

(6) **Electrical Laboratory.**—Tracing circuits and wiring, calibrating instruments, efficiency tests of storage batteries, and the candle power of incandescent lamps. Prerequisite: Physics (2). Textbook: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II, 2.

(7) **Electrical Diagrams.**—Conventional methods of representing electrical wiring and appliances. Drawings and wiring diagrams of the switchboards in the laboratory and in the power house and diagrams of the wiring of the college buildings. Laboratory, 2. I, 2.

(8) **Dynamo Design.**—Problems in designing electro-magnets, dynamos and motors. Complete working drawings and specifications to accompany each design. Prerequisite: Dynamo drawing. Reference: Design of Dynamos, by S. P. Thompson. Laboratory, 3. II, 3.

(9) **Alternating Currents.**—Theory of alternating currents, properties of alternating current circuits, principles of alternators, transformers, rotary converters and induction motors, methods of testing alternating current apparatus. Prerequisite: Physics (5). Textbook: Alternating Current Machines, by Sheldon, Mason & Hausmann. Lectures, 4. I, 4.

(10) **Electrical Laboratory.**—Laboratory tests of single phase alternating current generators, motors and transformers, calibration of alternating current measuring instruments and meters. Prerequisite: Physics (6). Textbook: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 3. I, 3.

(11) **Alternating Currents.**—Development of the symbolic method of Steinmetz, the solution of problems in transformer design and calculation of transmission line by the use of the algebra of complex numbers and by vector diagrams. Prerequisite: Alternating currents (9). Textbook: Alternating Current Phenomena, by Steinmetz. Lectures, 4. II, 4.



(12) **Electrical Laboratory.**—Laboratory tests of polyphase alternating current apparatus, including generators, motors, transformers and converters. Efficiency and regulation tests of a mercury arc rectifier, connecting transformers for transforming from three phase to two phase. Prerequisite: Electrical Laboratory (10). Textbook: Laboratory and Factory Tests in Electrical Engineering, by Sever & Townsend. Laboratory, 2. II, 2.

(13) **Electrical Designing.**—Drawing and design of alternating current apparatus, circuits, and power plants. Open to students taking E. E. (9) and E. E. (11). Laboratory, 3. I, 3.

(14) **Electric Power.**—Theory and construction of direct and alternating current generators, motors, transformers, and storage batteries; principles of power transmission and distribution. Textbook: Electrical Engineering, by T. Sewell. Lectures, 3. I, 3.

(14a) **Electrical Laboratory.**—Efficiency and regulation tests of batteries and direct and alternating current generators and motors; efficiency and polarity tests of transformers. Textbook: Experiments in Applied Electricity, by Rowland and Creagmile. Laboratory, 2. I, 2.

(15) **Wireless Telegraphy.**—Theory and development of wireless telegraphy; commercial apparatus and instruments for sending and receiving stations. Experimental tests. Prerequisite: Physics, (5). Textbook: Handbook of Wireless Telegraphy, by J. Erskine Murray. Lectures, 2. Laboratory, 1. I, 3.

(16) **Electrical Design.**—Design and drawing of a transformer or induction motor to conform with certain specifications for efficiency, including the calculations of the weight and cost of the material. Prerequisite: E. E. (9). Laboratory, 3. II, 3.

(17) **Seminar.**—Weekly meeting for the purpose of discussing current electrical engineering literature. Lectures, 1. I and II, 2.

(18) **Special Design.**—Design and construction of some special electrical apparatus or machine. Elective for seniors. Laboratory, 3. I or II, 3.

(19) **Illumination.**—Sources of light, laws of photometry and measurement of light, calculation of illumination, electric light wiring, Underwriters' rules and symbols of the National Contractors' association. Lectures, 2. II, 2.

(20) **Thesis.**—Before graduating each student must present a suitable thesis upon some engineering subject in line with his course. One copy of the thesis will be filed in the college library as the property of the college. The subject for the thesis must be chosen at the beginning of the senior year. 5. I and II, 5.

## MECHANICAL ENGINEERING.

Professor Dearborn.

Assistant Professor Challenger.

Mr. Miller.

Mr. Kately.

Mr. Park.

The facilities provided for the instruction and practice in the department of mechanical engineering include class rooms, drawing room and office occupying the south half of the basement of College Hall, wood shop, forge shop, iron and brass foundry, machine shop, office and reading room in the shop building, mechanical and material testing laboratory in the engineering laboratory, and the power plant of the college.

The drawing room is furnished with desks and drawers for one hundred and fifty-four students, and with numerous models, machine parts, and blue prints of trade machinery. The equipment includes also demonstration apparatus, blue print facilities, beam compasses, protractors, odontograph and universal drafting machine. The work in drawing and design is carried on in such a way as to bring out its relation to the subsequent work in the shops, sound commercial practice being emphasized.

The material testing laboratory equipment includes a Riehle 100,000 pound testing machine, both automatic and autographic, with extensimeter for tension and compression tests, and deflectometer for transverse tests; an Olsen torsion machine for specimens having a cross section up to one and one-fourth inches square; also micrometers, surface plate and gauge with micrometer indicator for testing parallelism, calipers, scales, etc.

The equipment available for steam and gas engine tests comprises, in part, the following: A 7x7 inch vertical steam engine with eccentric adjustable; an 8x12 inch automatic cut-off Woodbury engine, with water cooled brake wheel, connected up with a 50 H. P. Dean Bros. surface condenser and arranged to run condensing or non-condensing and with or without live or exhaust steam in the cylinder jacket; an 11x12 inch automatic cut-off Lycoming engine direct-connected to a 40 K. W. direct current generator, furnishing light and power for the college; a 12 H. P. Reeves throttling governor gasoline engine; a 12 H. P. two-stroke cycle Ellis oil engine; several small gasoline engines; an 8x8 Ingersoll-Rand air compressor; a 6½ inch by 9 inch Wolf ammonia refrigerating machine, driven by Corliss engine; all necessary brakes, generators and lamp banks for loading the engines; scales, meters, tanks, etc. In addition there are planimeters, separating and throttling calorimeters, thermometers, one Tabor (outside spring) gas indicator, one Thompson steam indicator, two sets steam indicators, with electro-magnetic device for taking simultaneous cards, one set

ammonia indicators, standard pressure gauges, apparatus for testing gauges and indicator springs under steam pressure and a Crosby oil pressure gauge testing outfit.

A one hundred twenty-five horse-power Root water tube boiler, a one hundred and twenty-seven horse-power Stirling water-tube boiler, a Baldwin locomotive, of the 4-4-0 class, an Advance compound traction engine, several oil and gasoline tractors, together with pumps, ejectors, feed water heaters, fans, etc., and the station heating plant, furnish extensive facilities for the investigation of problems related to power production, heating and ventilation.

The shops are equipped with standard machinery, and tools for working wood and metal. This equipment is being added to as needed, largely by manufacture in the shops by the students, under the supervision of competent foremen.

The wood shop measures 36x50 feet and is furnished with modern wood-working machinery, including a 20 inch Fay planer, a 14 inch circular pattern saw, a 36 inch band saw, a Fay universal jointer, a Fay and Egan friezer, a jig saw, foot mortiser, trimmer, a 16 inch pattern lathe, seven 10 inch lathes with turning tools for thirty-six students, and seventy-two complete sets of carpenter tools, with benches for joinery, house carpentry, pattern work and cabinet work.

The forge shop is 28x60 feet and contains nineteen down draft power forges with Sturtevant blowers, a 50-lb. power hammer, shear, grinder, and a full equipment of anvils and small tools. In the work here a graded series of exercises leads the student from simple drawing and upsetting to size, to complex forging and tool making, hardening and tempering, all the work being done from working drawings.

The foundry, 30x48 feet, is equipped with a No. 1 Whiting cupola having a melting capacity of one ton of iron per hour, a brass furnace, core oven, crucibles, flasks and patterns. The work comprises bench and floor moulding, cupola and brass furnace practice, the product consisting of castings of machine parts, test bars, brass, bronze and other alloys for bearing metal, ornamental pieces, etc.

The machine shop measures 60x72 feet, and adjoining it are the tool room, stock room, office, lavatory and locker room. The equipment includes an 18-inch Davis and Egan, a 16-inch LeBlond and three 16-inch Flather engine lathes, a 14-inch Lodge and Shipley patent head tool room lathe, a 22-inch Flather planer, a 16-inch Davis and Egan shaper, a Gisholt tool grinder, a 28-inch Cincinnati drill, a 20-inch Prentice drill, a 14-inch sensitive drill, a 24-inch Barnes grinder, a 6-inch pipe machine, speed lathe, power hack saw, etc., and in the tool room a No. 1 Cincinnati universal milling machine, a Cincinnati universal grinder, a Yankee drill grinder, a brazing and tempering outfit, besides a complete equipment of small tools.

(1) **Mechanical Drawing.**—The use of drawing instruments and plain lettering; problems in geometric construction to teach accuracy in the use of instruments; orthographic projection; dimensions, arrangement, titles; tracing and blue-printing. Before beginning work,

a student must provide himself with one of the following sets of drawing instruments or a set of equal quality: K. & E. No. 896 NCP with No. 523½ pen, or Dietzgen No. 937C with No. 508 pen. Laboratory, 3. I, 3.

(2) **Wood-work.**—A graded set of problems is given with instruction in the proper use and care of carpenter's tools and practice in working to dimensions from blue-prints, followed by a course in building construction, roof framing and mill work. Tools required: One B. & S. caliper rule. Laboratory, 2. II, 2.

(2a) **Pattern Work.**—A graded series of exercises in wood turning, followed by lectures and practice in the construction of wood patterns for use in the foundry. Prerequisite: M. E. (2). Tools required: One 6-inch steel rule, 5-inch outside calipers. Laboratory, 2. I, 2.

(3) **Descriptive Geometry.**—Projections of lines, plane surfaces and solids; intersections, tangents to curves and surfaces; problems in warped surfaces; practical applications. Text: Phillips & Millar. Lectures, 1; laboratories, 3. II, 4.

(4) **Foundry.**—The instruction includes practice in floor and bench molding, core making, and in pouring castings of iron, brass and other alloys. Laboratory, 1. II, 1.

(4a) Cupola and brass furnace practice in the manufacture of castings for machine parts, pipe fittings, test pieces, bearing metal, etc. Prerequisite: M. E. (4). Lectures or laboratory, 1. I, 1.

(5) **Mechanism.**—A study of the relative motions of machine parts, including rolling cylinders and cones, lobed wheels, belts, levers, cams, linkwork, parallel and straight line motions, as applied in engine indicators, indicator reducing motions and motor-car steering mechanisms. The design of cams and quick-returns for machine tools, with their velocity and acceleration diagrams. Text: Schwamb and Merrill, Elements of Mechanism. Lectures, 2; laboratory, 2. I, 4.

(6) **Forge Work.**—A graded set of exercises in iron forging, designed to teach the management of the forge fire, and the operations of drawing, upsetting, forming and welding, followed by exercises in forging, hardening and tempering tool steel. Tools required: One B. & S. caliper rule. Laboratory, 3. I, 3.

(7) **Steam Engineering.**—A study of steam boilers, their classification and construction, their settings, furnaces and chimneys, and of the construction and use of the various accessories and appliances found in the boiler room! a careful study of combustion and furnace efficiency, and of the principles underlying the economical transfer of heat from the furnace to the water. Scale, corrosion and feed water treatment are given considerable attention. Text: Peabody and Miller, Steam Boilers. The course must be preceded or accompanied by (16). Prerequisites: Chemistry (1), and physics (1) and (2). Lectures, 2. I, 2.

(8) **Mechanism.**—A continuation of (5) in the study of gearing; the cycloidal and involute systems, spur, bevel and screw gears, and the construction of the tooth; gearing in train, change gears for ma-



chine tools; epicyclic trains, with special application to automatic feeds, and differential transmission for tractors; intermittent motion, clicks, ratchets and escapements. Lectures, 2; laboratory, 2. II, 4.

(10) **Valve Gears.**—An analytic and graphic study of steam engine valve motions, and the use of the Zeuner, Bilgram and harmonic diagrams in the design of plain and double valves to fulfill given conditions. Reversing gear, Stephenson's link, radical gears, as applied to locomotives and tractors, and drop cut-off and non-releasing gears are analyzed and compared. Prerequisite: Mechanism (8). Laboratory, 2. I, 2.

(11) **Seminar.**—Weekly meetings for the presentation and discussion of papers upon assigned topics pertaining to mechanical engineering. Lecture, 1. I and II, 2.

(13) **Machine Design.**—A study of machines with regard to material, form and strength of parts, methods of construction. The development of rational and empirical formulae, the construction and interpretation of graphical charts involving engineering principles and data, and the graphical solution of problems involving stresses in cranes, structural members and machine parts. Complete working drawings, with notebook showing all calculations involved in the design of a power shear or press, hydraulic riveter or geared pump are required. Text: Kimball and Barr. Prerequisite: M. E. (10). Lectures, 3; laboratory, 3. II, 6.

(14) **Strength of Materials.**—The work consists of experimental determinations of the strength and various moduli of the more important of the materials of engineering. Tests are made in compression, tension, cross-bending and torsion, upon which written reports and discussions are required, involving a discriminating comparison of results with accepted experimental data. Taken with mechanics (6). Laboratory, 1. II, 1.

(15a) **Mechanical Laboratory.**—The use and testing of micro-meters, planimeters and slide rules. The calibration of pressure gauges, indicator springs, scales and tachometers, and efficiency tests of jack screws and hoists. Reference: Carpenter and Diederich's Experimental Engineering. Prerequisite: Physics (1). Laboratory, 2. II, 2.

(16) **Power Plant Practice.**—Each student spends five hours per week as assistant in the college power plant, obtaining practical experience under a first-class stationary engineer in handling boilers, pumps, engines, heating apparatus, and electrical machinery, including dynamos, motors, and switchboard. Laboratory, 2. I, 2.

(17) **Machine Work.**—Instruction and practice in chipping, filing, laying out, fitting, scraping, soldering and brazing. Prerequisites: Forge (6), Foundry (4). Tools required: One 6-inch steel rule; 5-inch outside calipers. Laboratory, 2. II, 2.

(18) **Thermodynamics.**—A study of the principles and their technical application to gases, saturated and superheated vapors, and mixtures, comprising cycle processes, the flow of fluids through nozzles, and throttling processes, from the physical, analytical and graphical



standpoint. The work includes the solution of numerous practical problems involved in the design and operation of steam and gas engines, steam turbines, steam calorimeters, injectors, air compressors and refrigerating machinery. Text: Goodenough, Principles of Thermodynamics. Prerequisites: M. E. (7, 16). Lectures, 4, II, 4.

#### FOR MECHANICAL AND CHEMICAL ENGINEERING STUDENTS.

(18a) **Heat Power.**—An elementary course dealing with the thermodynamic principles involved in the operation of steam engines and turbines, gas and oil engines. Prerequisites: M. E. (7), (16). For electrical engineering students. Lectures, 2. II, 2.

(20) **Steam and Gas Laboratory.**—Steam and gas engine indicator practice, valve setting by measurement and by the card, calorimetric determination of the quality of steam, tests of pumps, injectors, and engines. Prerequisite: Thermodynamics (18). Laboratory, 2. I, 2.

(21) **Machine Work.**—Practice with instruction in drilling, boring, turning, thread and gear cutting. Prerequisite: (17). Tools required: Six-inch steel rule, 5-inch outside and inside calipers, center gage. Laboratory, 2. I, 2.

(22) **Gas Engineering.**—An extension of (18) in a study of the performance and design of gas motors, gas producers and other gas machinery, and air machinery from the thermodynamic standpoint. Text: Ennis, Applied Thermodynamics; Heck, Steam Engine and Turbine. Lectures, 3. I, 3.

(23) **Engine Design.**—A course co-ordinating with (22) in the dynamics of machinery, with particular application in the design of the reciprocating parts of steam and gas engines, flywheels and governors. Balancing, stresses in turbine discs and critical velocity of shafts are discussed. Each student makes working drawings for a transmission dynamometer and a gas engine. Text: Lanza, Dynamics of Machinery. Lectures, 2; laboratory, 2. I, 4.

(24) **Heating and Ventilation.**—A course designed to cover the principles of heating buildings by the various systems using steam, air and hot water, and of ventilation, with calculations for specific installations, and complete specifications and estimate of costs. Prerequisite: M. E. (7). Lectures, 2. I, 2.

(25) **Industrial Engineering.**—The organization and management of manufacturing establishments; cost accounting, distribution of expenses, depreciation and amortization; systems of compensating labor. Lectures, 2. II, 2.

(26) **Steam Engineering.**—An extension of (18) with special application to the performance and design of steam motors and refrigerating machines. Lectures, 2. II, 2.

(27) **Machine Tool Work.**—Advanced work on lathe, milling machine, and grinder. The manufacture of reamers, drills, taps, mills, and dies. The heat treatment of high speed steel. Laboratory, 2. II, 2.

(28) **Engineering Laboratory.**—A continuation of (20), including

efficiency tests of heating, ventilating, compressed air, refrigerating and power plant equipment, steam and gas power plants and machinery, locomotive tests. Laboratory, 2. II, 2.

(29) **Plant Design.**—The course comprises the design of a plant for a specific purpose—i. e., a heating, pumping, lighting, refrigerating, compressed air or shop plant. Lectures and recitations cover the location and construction of the buildings; heating, ventilating, lighting and fire protection systems; the working equipment and its arrangement; while working drawings are made showing the location of equipment, with calculations and specifications for certain details. Lectures, 1; laboratory, 2. II, 3.

(30) **Thesis.**—Before graduating, the student is required to present an acceptable thesis involving an investigation of some problem related to mechanical engineering, which will become the property of the college. The work will be done under the supervision of the head of the department, but the student will devise his own methods. The subject must be selected by November fifteenth of the senior year. II, 4.

(31) **Machine Design.**—A continuation of (23) in the design of power machinery, the particular project to be selected by each student from a list of options. Laboratory, 2. II, 2.

## CHEMICAL ENGINEERING.

Professor Cobleigh.  
Assistant Professor Barnes.

(13) **Chemical Factory Machinery.**—This is an introductory course in industrial chemistry. Lectures are given on the types of machinery used in carrying on chemical processes. Attention is given to the general operations common to many industries such as crushing, grinding, calcination, fusion, distillation, filtration, crystallization, etc. The course also includes lectures on the production of iron, steel and copper. Prerequisite: Chemistry (3). II, 3.

(14) **Industrial Chemistry.**—This is a course which treats by means of lectures and laboratory exercises some of the more important technical chemical processes. The topics considered are the following: Lime, mortar, cement, refractory materials, glass, fertilizers, explosives, alkalies, acids, paints, pigments, soap, sugar, paper, etc. The lectures are illustrated by charts, models, lantern slides, and museum specimens of raw materials and finished products. The laboratory exercises are selected to supplement the lecture work and are taught from the standpoint of chemical engineering. Inspections and reports on the various industrial plants in the state are required in the course. Prerequisites: Chemistry (3) and (13). I, 5. II, 2.

(17) **Fuel Analysis.**—This is a course in the production and analysis of solid, liquid and gaseous fuels, illuminating gas, and lubricating oils. Prerequisite: Chemistry (14). II, 3.

(18) **Water Analysis.**—Lectures and laboratory practice in the chemical examination of potable waters, of water for industrial purposes and steam raising, of sewages, and of air. Lectures on water purification and softening, and sewage treatment, and also the interpretation of water analysis. Prerequisites: Chemistry (1), (2) and first semester of Chemistry (3). II, 4.

(19) **Physical Chemistry.**—A course in theoretical chemistry consisting of lectures, recitations assigned problems, and laboratory work. The discussions include the following topics: The gas laws, thermodynamics, solutions, chemical mechanics, equilibrium in electrolytes, and electro chemistry. Prerequisite: Chemistry (3). Text book: Morgan's Physical Chemistry for Electrical Engineers. I, 4.

(20) **Seminar.**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors where the topics are freely discussed. Students are thus kept in touch with the progress of the science. I and II, 2.

(21) **Thesis.**—Students in the chemistry course may in the senior year prepare a graduate thesis on some subject which will involve considerable work and as much originality as possible. I and II, 4.

## ARCHITECTURAL ENGINEERING.

Assistant Professor Plew.

(1) **Freehand Drawing.**—Practice in free hand drawing from casts, and principles of perspective, shades and shadows; charcoal, pen pencil and wash drawing from cast and still life; sketching; the orders of architecture. Laboratory, 5. I, 2. II, 3.

(2) **Working Drawing.**—Specifications and working drawings. The growth, cutting and seasoning, working and finishing woods; detailing on a large scale of floors, roofs, windows, stairs, cornice; cabinet making. Laboratory 3. I, 3.

(3) **History of Architecture.**—A study of architectural design from the early period to modern times, evolution of architectural forms from the Egyptian to modern times. Architecture of the various countries and periods. Lectures, II, 3. I, 3. II, 3. 9.

(4) **Elementary Design.**—Problems in rendering of the orders and sketch problems involving simple composition. Laboratory, 3. II, 3.

(5) **Building Sanitation.**—Design and installation of plumbing; removal of waste; sewage disposal; water supply and fixtures in dwellings. Lectures, 2. II, 2.

(6) **Specifications and Working Drawings.**—Plan and framing problems; balloon framing, and detailing of walls, etc. Laboratory, 3. II, 3.

(7) **Estimating.**—Methods of estimating building costs, with practice in the same. Lecture, 1. I, 1.

(8) **Architectural Engineering.**—Analysis of metallic roofs of wide span; roof truss of curved and unusual form; standard vault and dome, construction details of large skeleton buildings; strength of walls, dams, retaining walls, and large chimneys; spherical and conical trussed domes. Laboratory, 5. Lecture, 1. I, 3. II, 3. 6.

(9) **Architectural Seminar.**—Current literature, reports and discussions. I, 1. II, 1.

(10) **Architectural Decoration.**—Interior and exterior ornamental design and finish of buildings. Laboratory, 2. II, 2.

## IRRIGATION ENGINEERING.

Professor.....

(1) **Irrigation Engineering.**—History of irrigation; the principles of irrigation and the location of irrigation systems; details of irrigation systems. Lectures, I, 3.

(2) **Irrigation Engineering.**—Manner of supplying, storing, conveying and distributing irrigation water; irrigation laws; management of irrigation systems. Prerequisites: I. E. (1 and 4). Lectures, 3. II, 3.

(3) **Canal Management.**—Canal management, seepage, and damage. Prerequisite: I. E., (2). Lectures, 3. II, 3.

(4) **Hydraulics.**—Theoretical hydraulics, hydraulic measurements; flow of water through orifices, over weirs, through pipes, conduits and canals. Text: Merriman's Hydraulics. Prerequisites: Mathematics, (1), (2) and (4); physics, (1) and (2). Lectures, 3.

(5) **Hydraulic Engineering.**—Precipitation, drainage area, runoff, water power development. Prerequisite: I. E., (4). Lectures, 3. I, 3.

(6) **Hydraulic Laboratory.**—Flow of water over weirs, through nozzles and pipes, etc. Flow of water in open channels. Prerequisite: I. E., (4). Laboratory, 2. II, 2.

(7) **Pumping for Irrigation.**—Small rotary and reciprocating pumps. Steam, gas and oil engines used for pumping. Electric pumps. Lectures, 3. II, 3.

(8) **Seminar.**—Current Literature, reports and discussions. II, 1.

(9) **Thesis.**—II, 3.



## Engineering Extension Work

The College of Engineering Extension Work has been inaugurated in order to give engineering instruction to those who desire information along engineering lines and who have not the time or the opportunity to attend the college. The courses, arranged so as to aid those engaged in practical work, consist of lectures, discussions, recitations, drawing, etc. When a sufficient number apply for one or more courses, classes are organized and an engineering instructor visits the classes, once a week, to lecture or to conduct class recitations. In this way the student comes in direct contact with the instructor. Among the courses offered are the following:

- I. **Shop Calculations.**—Calculations of shop problems; size of gear, pulleys, etc.
- II. **Drawing, Course 1.**—Instruction in the use of instruments, lettering and projections.
- III. **Drawing, Course 2.**—Development of surfaces and the drawing of simple machine parts.
- IV. **Design of Simple Structures.**—Determination of stresses in simple structures, including the design of a simple truss in wood and steel. Especially adapted to the needs of carpenters, builders and contractors.
- V. **Valve Gears.**—A study of valve movements as applied to locomotive and other engines. The Zeuner diagram.
- VI. **Electrical Machinery.**—Direct currents, a study of the construction and operation of direct current machinery.
- VII. **Electrical Machinery.**—Alternating currents, a study of the construction and operation of alternating current machinery.
- VIII. **Heat and Steam.**—Nature of heat, use of steam table, efficiency of the perfect engine, compounding, jacketing, superheating.
- IX. **Internal Combustion Engines.**—Gas, gasoline and producer gas engines, gas producers.

## College of Industrial Arts and Sciences

Five separate courses each leading to the degree of Bachelor of Science are offered in the College of Industrial Arts and Sciences. They are Biology, Chemistry, Home Economics, Applied Art and Secretarial Work. A detailed statement of the purpose and scope of each course may be found on the page preceding the tabulation of the course. Each course contains a large proportion of the applied and industrial phases of the art or science of which it is the representative and prepares the students for a definite field of work. In the earlier years much of the foundation work in English, science and foreign languages is common to all the courses. The junior and senior years are filled largely with the technical subjects naturally belonging to the course.

Several subjects taught in departments not represented in this division are open to election by students on consent of their advisers. Among these may be mentioned music (limited to four credits for any one person) and such subjects in the divisions of agriculture or engineering as the applicant may be qualified for and as the schedule permits.

## Biology

In the biology department are combined all the work in botany, zoology, entomology and bacteriology, making it a large and comprehensive department. It is organized to serve two purposes, the first is to provide fundamental work in the study of plants and animals as a foundation for agricultural studies; the second is to fit men for professional careers in the various branches of biological science with especial reference to teaching and research work in agricultural colleges, experiment stations and the government service.

In the quality of the courses offered every effort is made to equal similar courses in the large universities and this work has repeatedly been given full recognition by these institutions. Without sacrifice to this ideal it has been found possible to give a strongly economic character to the courses.

Students in the four year biology course are allowed considerable latitude in choosing their electives that they may specialize along the lines of botany, zoology, entomology, plant pathology or bacteriology. Considerable work is, however, required for all in chemistry, physics and other sciences and those who desire may use their electives to make it a general science course along agricultural lines.

This course also furnishes an excellent preliminary training for professional work such as medicine and veterinary science.

With the great awakening in scientific agriculture vastly greater opportunities are offered in the biology professions. Much of the research work as a basis for agriculture must of necessity be done by the specialists in science and many of the great agricultural problems are being solved in part by them. The increased federal and state appropriations for research and extension along these lines furnish opportunities heretofore unknown and the demand is large for capable young men trained along biological lines and capable of carrying on work in the experiment stations and the U. S. Department of Agriculture.

## BIOLOGY.

## FRESHMAN YEAR

First Semester.		Second Semester	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4).....	1
Trig. and Log. (Math. 2a).....	3	*Principles of Plant Culture	
General Chemistry (Chem. 1) ..	4	(Hort. 1) .....	3
General Botany (Biol. 9).....	5	General Chemistry (Chem. 1) ..	4
*Mechanical Drawing (M. E. 1)	2	*Field Crops (Agron. 1).....	5
Drill or Gymnasium.....	1	Drawing from Nature (Art. 4)	2
		Drill or Gymnasium .....	1
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	18		18

## SOPHOMORE YEAR.

Expository Composition (Eng. 2)	2	Expository Composition (Eng. 2)	2
Qualitative Analysis (Chem. 2)	4	Organic Chemistry (Chem. 5)	5
General Descriptive Physics		General Descriptive Physics	
(Phys. 1a) .....	3	(Phys. 1a) .....	3
Invertebrate Zoology (Biol. 1)	4	Human Physiology (Biol. 3) ..	5
Economic Entomology (Biol. 4)	5	Geology (Geol. 1).....	3
Drill or Gymnasium.....	1	Drill or Gymnasium .....	1
	—		—
	19		19

## JUNIOR YEAR.

Advanced Composition (Eng. 3)		Advanced Composition (Eng. 3)	
or Literature (Eng. 10).....	2	or Literature (Eng. 10).....	2
Bacteriology (Biol. 12).....	5	Take three of these:	
General and Systematic Entomology (Biol. 5).....	4	Advanced Economic Entomology	
Vertebrate Zoology (Biol. 2) ..	4	(Biol. 6).....	4
Elective ....	2 to 4	Plant Pathology (Biol. 11)....	4
		Plant Physiology (Biol. 10)...	4
		Organic Evolution (Biol. 14) ..	3
		*Farm Mechanics (Agron. 4) ..	3
		Elective.....	2 to 3
	—		—
	17 to 19		17 to 19

## SENIOR YEAR.

Economics (Econ. 3).....	2	Economics (Econ. 3).....	2
Psychology (Phil. 1).....	3	Sociology (Econ. 4).....	3
Thesis ....	5	Thesis .....	5
Elective .....	7 to 8	Elective.....	7 to 8
	—		—
	17 to 18		17 to 19

\*Women may elect other subjects.

## Chemistry

The principles of chemistry, together with some of the applications of the science, are taught to the freshmen in all courses offered by the college. In addition to this elementary instruction some departments require sufficient training in chemistry to enable the student to apply the principles of the science to some special phase of the general course he is pursuing. This is true in the college courses in agriculture, domestic science, chemical engineering and sanitary engineering. Further, students who wish to specialize in chemistry are advised to take systematic training in the science during the four years of undergraduate study.

The outline of studies offered in the chemical course is designed to meet the needs of the last named class of students. The sub-courses listed in the freshman and sophomore years leave no room for electives and are required of all students registering in the chemistry course. These courses are all fundamental and are prerequisite to both the required and elective work offered in the last two years of the course.

Electives are offered in the junior and senior years in order that other subjects may be combined with chemistry with the idea of shaping the training toward some special field of the science. By a proper selection of electives it is possible to prepare for the following more or less distinct branches of the science: industrial chemistry, agricultural chemistry and biochemistry. The electives will be assigned on consultation with the class officer as follows:

**Industrial Chemistry.**—Electives may be taken from the sub-courses in civil, mechanical and electrical engineering, physics, mathematics, chemistry and language.

**Agricultural Chemistry.**—Electives are to be chosen from the sub-courses in biology, agriculture, chemistry, geology and language.

**Biochemistry.**—Electives must be selected from the sub-courses in biology mainly, together with language, physics and chemistry.

The industrial option offers a combination of studies that prepares for positions in chemical laboratories connected with manufacturing industries and for conducting operations requiring a working knowledge of both chemistry and engineering.

The agriculture, and biochemistry options give an excellent foundation for the study of almost any phase of agricultural science. They especially prepare for positions in experiment station laboratories and in government and state food laboratories.



## CHEMISTRY.

## FRESHMAN YEAR

First Semester.		Second Semester.	
English Composition (Eng. 1)	2	English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1	Public Speaking (Eng. 4)	1
Algebra (Math. 1)	3	Analytical Geometry and Calculus (Math. 3)	4
Trigonometry (Math. 2)	2	German or French	4
German or French	4	General Chemistry (Chem. 1)	6
General Chemistry (Chem. 1)	4	Drill	1
Mechanical Drawing (M. E. 1)	2		
Drill	1		
	19		18

## SOPHOMORE YEAR.

Qualitative Analysis (Chem. 2)	4	Organic Chemistry (Chem. 5)	5
Analytical Geometry and Calculus (Math. 4)	5	Analytical Geometry and Calculus (Math. 4)	5
Engineering Physics (Phys. 1)	3	Engineering Physics (Phys. 1)	3
Physical Measurements (Phys. 2)	2	Physical Measurements (Phys. 2)	1
German or French	4	German or French	4
Drill	1	Drill	1
	19		19

## JUNIOR YEAR.

Economics (Econ. 3)	2	Economics (Econ. 3)	2
Mineralogy (Geol. 2)	4	Geology (Geol. 1)	3
Advanced Inorganic Chemistry (Chem. 6)	2	Advanced Inorganic Chemistry (Chem. 6)	2
Quantitative Analysis (Chem. 3)	5	Quantitative Analysis, (Chem. 3)	2
Elective	4 to 6	Chemical Factory Machinery (Chem. 13)	3
	17 to 19	Elective	5 to 7
	17 to 19		17 to 19

## SENIOR YEAR.

Industrial Chemistry (Chem. 14)	5	Industrial Chemistry (Chem. 14)	2
Physical Chemistry (Chem. 19)	4	Fuel Analysis (Chem. 17)	3
Seminar (Chem. 20)	1	Seminar (Chem. 20)	1
Elective	7 to 9	Water Analysis (Chem. 18)	4
	17 to 19	Elective	7 to 9
	17 to 19		17 to 19

## Home Economics

The object of this course is two-fold: First, to give young women a liberal education with a scientific basis, and to train them along lines pertaining to the science, management and care of the home. Second, to give training to those who wish to become teachers of home economics. This course gives an opportunity for the combination of biology chemistry, physics and art with home economics.

In the junior and senior years there is considerable opportunity for electives, but electives must be chosen by the advice and with the approval of the class officer. A choice is given in the junior year between history and science, music and English may be elected. History, chemistry, biology, art, music and English may be elected in the senior year.

Students expecting to teach will take Home Economics courses (8) and (15). Other students may substitute work approved by the class officer. Those expecting to do advanced work in home economics or to teach in high schools are advised to take physics (9), chemistry (11), and history (10). Advanced food studies (5) is offered as an elective in the senior year.

### HOME ECONOMICS. FRESHMAN YEAR

First Semester.		Second Semester.	
English Composition (Eng. 1) 2		English Composition (Eng. 1) 2	
Public Speaking (Eng. 4)..... 1		Public Speaking (Eng. 4)..... 1	
German (10) or (12) or French		German (10) or (12) or French	
(1) ..... 4		(1) ..... 4	
History (7) or..... 4		Prin. of Cookery (H. E. 1).... 4	
Trig. and Math. (2a)..... 3		General Chemistry (Chem. 1). 4	
General Chemistry (Chem. 1).. 4		Art (Art 7)..... 2	
Sewing (H. E. 11)..... 3		Physical Education ..... 1	
Physical Education .... 1			
<hr/>		<hr/>	
18 or 19		18	

### SOPHOMORE YEAR.

Expository Composition(Eng. 2) 2		Expository Composition(Eng. 2) 2	
German (11) or(13) or French		German (11) or (13) or French	
(1) or (2) ..... 4		(1) or (2) ..... 4	
Organic and Food Chemistry		Organic and Food Chemistry	
(Chem. 8) ..... 4		(Chem. 8) ..... 3	
Invertebrate Zoology (Biol. 1) 4		Food Studies (H. E. 2)..... 4	
Dressmaking (H. E. 12)..... 2		Animal Physiology (Biol. 3).. 5	
Household Architecture(H.E.3) 2		Physical Education ..... 1	
Physical Education ..... 1			
<hr/>		<hr/>	
19		19	

### JUNIOR YEAR.

Economics (Econ. 3)..... 2		Sanitation (Biol. 16)..... 2	
Bacteriology (Biol. 12)..... 5		Economics (Econ. 3) ..... 2	
Textiles (H. E. 13)..... 3		Dressmaking (H. E. 14)..... 3	
Adv. Cookery (H. E. 4)..... 2		Costume Design (Art 8)..... 2	
History (5) or (10) or..... 3		Household Management(H.E.7) 3	
Household Physics (Phys. 9).. 3		History (5) or (10) or ..... 3	
Household Decoration (Art 8b) 2		Animal Nutrition (Chem. 11).. 3	
Electives ..... 1 or 2		Elective.... .. 4	
<hr/>		<hr/>	
18 or 19		19	

### SENIOR YEAR.

Psychology (Phil. 1)..... 2		Sociology (Econ. 4)..... 3	
Seminar (H. E. 10)..... 2		Teaching Domestic Science	
Dietetics (H. E.6)..... 4		(H. E. 8) ..... 3	
Teaching Domestic Art (H. E.		Embroidery (H. E. 16)..... 2	
15) .... 2		Home Problems (H. E. 3) 3 or	
Electives.... .. 6 or 8..		4 ..... 4	
		Electives ..... 4 to 6	
<hr/>		<hr/>	
16 or 18		16 or 18	

## Applied Art

That the study of drawing is important in education is now universally acknowledged. Aside from the advantage to engineers, machinists, and architects of practical knowledge of draughtsmanship, the psychologic value of a knowledge of drawing is very great. The chief object of education is in the quickening of the powers of the mind. Drawing brings out the power of analysis, habits of observation, qualities of judgment, imagination, memory and taste. It is something more than mere training of the eye. To achieve even moderate success requires that thought be put into every line.

Art, aside from anything we can produce, helps us to appreciate the work of great artists and opens our eyes to the beauty of form and color in nature. It extends our powers of enjoyment and gives us a better understanding of the history of the human spirit. It gives a proper gratitude for the work of the great artists.

With the coming of the applied arts movement, has come the demand for work in manual training directly related to, and based upon art principles. With the purpose in view courses are offered in artistic handicraft, jewelry, hammered metal, pottery and leather work with all the facilities and equipment needed for artistic and practical work.

The art course, as here outlined, will indicate the work of the average student in a four year's course planned for those who attend mainly for art work. The student is carried forward just as rapidly as his own talent and industry will permit.

The course offers thorough training in the study of form, color, ornament, historic art, principles of design and composition and in technical methods in applied design. It insures a broad foundation of art culture and skill which will enable students to make practical use of their training. The theory of design is presented as fundamental to the crafts. Exceptional facilities are offered for the study of design and composition and the course is strengthened by the many phases of related art work. Every effort is made to teach drawing. The pupil is then encouraged to follow any line of art work for which he seems best fitted. Applied design, interior decoration, handicraft work or teaching.

Attention is called to the regulation printed on page 22 regarding work done suitable for exhibition purposes.

### APPLIED ART. FRESHMAN YEAR

First Semester.		Second Semester.	
English Composition (Eng. 1) 2		English Composition (Eng. 1) 2	
German or French ..... 4		German or French .... 4	
Public Speaking (Eng. 4)..... 1		Public Speaking (Eng. 4)..... 1	
General Botany (Biol. 9)..... 5		Cooking (H. E. 1)..... 4	
Drawing (Art 1)..... 2		Physiology (Biol. 3)..... 5	
Sewing (H. E. 11)..... 3		Design (Art 7).... 2	
Physical Education .... 1		Physical Education .... 1	
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18		19	

### SOPHOMORE YEAR.

English Literature (Eng. 10).. 2		English Literature (Eng. 10).. 2	
German or French.... 4		German or French .... 4	
History (2)..... 3		History (2) .... 3	
Drawing (Art 1) ..... 2		Drawing (Art 1)..... 2	
Design (Art 7).... 2		Design (Art 7) ..... 2	
Water Color (Art 2) ..... 2		Handicraft (10-11-12 or 13)... 2	
Handicraft (10-11-12 or 13)... 2		Water Color (Art 2)..... 2	
Physical Education .... 1		Physical Education .... 1	
—		—	
18		18	

### JUNIOR YEAR.

Interpretive Reading (Eng. 6) 2		Interpretive Reading (Eng. 6). 2	
Household Physics (Phys. 9).. 3		Advanced Design (Art 7b).... 3	
History of Art (6)..... 2		History of Art (Art 6)..... 2	
Drawing (Art 1)..... 2		Drawing (Art 1)..... 2	
Water Color (Art 2)..... 2		Water Color (Art 2)..... 2	
Handicraft (10-11-12-13) ..... 2		Handicraft (10-11-12-13) ..... 2	
Elective .... 5		Elective.... 5	
—		—	
18		18	

### SENIOR YEAR.

Psychology (Phil. 1) ..... 3		Sociology (4) ..... 3	
Methods (Art 18a) ..... 2		Methods (Art 18b)..... 2	
Color Work ..... 2		Color ..... 2	
Thesis ..... 3		Thesis..... 3	
Elective .... 9		Elective .... 9	
—		—	
19		19	



## Two-Year Art Course

The two-year course is offered to meet the needs of those students who have marked ability and who wish to specialize in art with a view to teaching the subject in public schools.

The entrance requirements are the same as for the four-years course and a certificate is granted upon the completion of the course.

## TWO-YEAR ART COURSE

## Design and Handicraft.

## FIRST YEAR.

## First Semester.

English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1
Drawing (Art 1)	2
Perspective (Art 15)	2
Art History (Art 6)	2
Design (Art 7)	2
Handicraft (10, 11, 12 or 13)	4
Physical Education	1
Elective	2

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## Second Semester

English Composition (Eng. 1)	2
Public Speaking (Eng. 4)	1
Drawing (Art 1)	2
Composition (Art 16)	2
Art History (Art 6)	2
Design (Art 7)	2
Handicraft (10, 11, 12 or 13)	4
Physical Education	1
Elective	2

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## SECOND YEAR.

English Literature (Eng. 10)	2
Drawing and Water Color	3
Methods (Art 18a)	2
Psychology (Phil. 1)	3
Design (Art 7)	2
Handicraft (10, 11, 12 or 13)	2
Practice Work (Art 17)	2
Physical Education	1
Elective	2

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English Literature (Eng. 10)	2
Drawing and Water Color	3
Methods (Art 18b)	2
Design (Art 7)	2
Handicraft (10, 11, 12 or 13)	2
Practice Work (Art 17)	2
Physical Education	1
Elective	2 to 5

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 16 to 19

## Secretarial Course

This is a college course requiring fifteen units of preparation for admission, and extends through four years of study. This is not a university course in commerce but a vocational course which prepares for specific kinds of work. There is a demand for young people with more advanced training than the commercial course in the high school. The Secretarial Course is intended to prepare for such positions as private secretary, office assistant, association secretary and institutional manager.

The course consists in a thorough grounding in English and modern foreign language, together with some home economics, science, history and social science. The technical work includes shorthand, typewriting, business methods, office practice and the principles of accounting. The freshman year is nearly the same as the freshman year in home economics and applied art. The choice may be delayed until the beginning of the sophomore year.

### SECRETARIAL COURSE. FRESHMAN YEAR

First Semester.		Second Semester	
English Composition (Eng. 1)..	2	English Composition (Eng. 1).	2
Public Speaking (Eng. 4).....	1	Public Speaking (Eng. 4) ....	1
German (10)or(12); French (1);		German (10)or(12); French(1);	
Spanish (20) .....	4	Spanish (20).....	4
English History (Hist. 1) ....	3	English History (Hist. 1).....	3
Chemistry (Chem. 1).....	4	Chemistry (Chem. 1).....	4
*Sewing (H. E.11).....	3	Business Correspondence(Sec.5)	3
Physical Education .....	1	Physical Education .....	1
—		—	
	18		18

### SOPHOMORE YEAR.

Expository Composition(Eng. 2) 2	Expository Composition(Eng. 2) 2
German (11) or (13); French	German (11) or (13); French
(2) .....	(2) .....
**History (Hist. 5 or 10)... .. 3	History (Hist. 5 or 10)..... 3
Shorthand (Sec. 1) .....	Shorthand (Sec. 1) .....
Typewriting (Sec. 3).....	Typewriting (Sec. 3).....
Physical Education ....	Physical Education ....
—	—
18	18

### JUNIOR YEAR.

English Literature (Eng. 10)..	2	English Literature (Eng. 10)..	2
Office Practice (Sec. 6).....	4	Business Methods (Sec. 7)....	4
Shorthand (Sec. 2).....	3	Shorthand (Sec. 2).....	3
Typewriting (Sec. 4) .....	3	Typewriting (Sec. 4).....	3
Elective....	6	Elective ....	6
—		—	
18		18	

### SENIOR YEAR.

Economics (Econ. 3) .....	2	Economics (Econ. 3) .....	2
Psychology (Phil. 1) .....	3	Sociology (Econ. 4) .....	3
Accounting (Sec. 9).....	3	Accounting (Sec. 9).....	3
Shorthand.....	2	Shorthand .....	2
Typewriting ....	2	Typewriting ....	2
Elective.....	4 to 6	Elective .....	4 to 6
—		—	
16 to 18		16 to 18	

\*Men may elect another subject.

\*\*Only one of these courses will be given in the sophomore year.

## Two-Year Secretarial Course

The two-year secretarial course is intended for those students who cannot remain to complete a four-year course. The completion of a high school course or its equivalent is required for entrance. The practical courses in shorthand, typewriting, etc., are the same as in the long course, but the foreign language, chemistry, economics and part of the history is omitted. Those who complete this course satisfactorily will be granted diplomas but no degree, and will be prepared to do secretarial and office work.



## TWO-YEAR SECRETARIAL COURSE FIRST YEAR.

First Semester.	Second Semester.
English Composition (Eng. 1) 2	English Composition (Eng. 1) . 2
Shorthand (Sec. 1) ..... 4	Shorthand (Sec. 1) ..... 4
Typewriting (Sec. 3)..... 4	Typewriting (Sec. 3)..... 4
*Sewing (H. E. 11)..... 3	Business Correspondence (Sec.
Office Practice (Sec. 6)..... 4	5) ..... 3
Physical Education ..... 1	Business Methods (Sec. 7).... 4
	Physical Education .... 1
—	—
18	18

## SECOND YEAR.

Expository Composition (Eng. 2) 2	Expository Composition (Eng. 2) 2
History (Hist. 1) ..... 3	History (Hist. 1) ..... 3
Shorthand (Sec. 2) ..... 3	Shorthand (Sec. 2) ..... 3
Typewriting (Sec. 4)..... 3	Typewriting (Sec. 4) ..... 3
Accounting (Sec. 9) ..... 3	Accounting (Sec. 9) ..... 3
Elective ..... 3	Elective.... 3
Physical Education.... 1	Physical Education ..... 1
—	—
18	18

\*Men may elect another subject.

**APPLIED ART.**

Assistant Professor Lana A. Baldwin.  
Miss Genevieve Lane.

The art department occupies the entire north front of the second floor in College Hall. The studios are large and well lighted.

The department has a very complete and carefully selected collection of casts from the antique, including full length casts of the Venus de Milo, Borghese Warrior and the Winged Victory.

The equipment for work in the handicrafts includes work benches and full sets of tools for each individual student electing work in metalry and jewelry, potter's wheels for throwing and casting pottery and a china kiln of the largest size for firing china.

There is a fine collection of works on art in the library suitable for class reading and serious study, also photographs from foreign countries and reproductions of celebrated pictures.

(1) **Drawing** from the cast in charcoal, pencil, crayon or pen and ink. Also still life and object drawing. I and II, 4, 6.

(2) **Water Color.**

(a)—Work from nature and still life. Prerequisite: Art (1). I and II, 6.

(b)—Illuminating on vellum or parchment. Prerequisites: Art (1) and art (7). I and II, 2-4.

(4) **Drawing from Nature.**—In pencil, pen and ink, wash and color. This is intended especially for students in biology. II, 2.

(5) **Clay Modeling.**—Decorative work from original designs, given in connection with study of historic ornament and design. I or II, 2.

(6) **History of Art.**—This work is intended especially for students in design. Particular attention is given to the study of historic ornament and the classic styles as exemplified in painting, sculpture and architecture. I and II, 4.

(7) **Design.**—Study of applied design and incidentally the use of water colors. Students submit original designs. I and II, 4, 6.

(7a) **Historic Ornament.**—A study of historic ornament with analysis of historic examples of design. Original problems executed in black and white and in color. Prerequisite: Art (7). I and II, 4.

(7b) **Advanced Design.**—Original designs for commercial purposes executed to meet the requirements and conditions of reproduction. I and II, 4.

(8) **Costume Design.**—The study of color and design as applied to dress. History of costume. This course is made as practical and helpful as possible. Students prepare original designs which are executed in the sewing classes. II, 2.

(8a) **Embroidery Design.**—Students study theory of color and design and submit original designs of embroidery. Work rendered in black and white and in color. II, 2.

(8b) **Household Decoration.**—Study of color, line and form as applied to house furnishings. Students are given practical problems to demonstrate these theories. I and II, 2-4.

(8c) **Decorative Periods.**—Advanced work in interior decoration. A study of decorative styles and their adaptation to modern uses. Original designs for interiors executed in color. Prerequisite: (8b). I and II, 4.

(9) **China Design.**—Study of applied design for the decoration of china. This includes study of color. I and II, 4.

(10) **Painting on China.**—Students to be admitted to the classes in china painting must satisfy the instructor that they have the necessary preparation to undertake the work profitably. China is fired in the studio. Prerequisites: (1), (2), (9). I and II, 4-8.

(11) **Leather.**—Tooling, modeling and embossing; also use of dyes and stains for leather. Prerequisite: (7). I and II, 4.

(12) **Jewelry.**—Making of simple and unique jewelry in silver and in copper. This includes saw-piercing, enameling, repousse and the setting of semi-precious stones. Prerequisite: Course (7). I and II, 4-6.

(13) **Metal.**—Work in copper, brass and silver. This course includes raising, saw-piercing, etching, hard and soft soldering and riveting. Prerequisite: Art (7). I or II, 4-6.

(14) **Basketry.**—The making of baskets of reeds and raffia and other suitable materials. Study of dyes and dying baskets. Use of native materials in original work in basketry.

(15) **Perspective.**—The principles of angular and parallel view perspective taught by means of freehand sketches and drawings. Work executed in pencil, pen and ink, wash and color. Lecture, 1; laboratory, 1. I, 2.

(16) **Composition.**—A study of art structure as a means of expression. Students submit original compositions in light and dark, line and color. Lecture, 1; laboratory, 1. II, 2.

(17) **Practice Work in Teaching.**—Teaching drawing, painting, design and handicrafts. I and II, 4.

(18a) **Methods.**—Methods of teaching drawing, painting and design. Lesson plans and materials I, 2.

(18b) **Methods.**—Methods of teaching the handicrafts; metal, jewelry, leather, basketry, wood block painting and stenciling. Lesson plans. Materials and equipment. II, 2.

**BIOLOGY.****Professor Cooley.****Professor Swingle.****Assistant Professor Spaulding.****Assistant Professor Jennison.**

While the primary object of the sub-courses in biology is to give the pupils a training in the sciences underlying animal industry, agriculture, horticulture and home economics, they are also well designed for purposes of education. They form a basis for an understanding of the various phases of the development of life, the problems of evolution and are an excellent preliminary to the study of social science.

The biology department now occupies the whole of the building formerly occupied by the experiment station and the agricultural departments, which has been remodeled and made more suitable for biological work. This building is 45 by 50 feet and three stories high. It contains the necessary lecture rooms, laboratories, library, collection and store rooms, and on the south side are attached two greenhouses which are used for college and experiment station work in plant physiology and pathology. In connection with the greenhouses are two large well stocked photographic dark rooms. The department is well equipped with lenses and other photographic equipment.

The library contains valuable sets of the more important books and periodicals treating of biological subjects. The department receives regularly forty-five biological periodicals and has more or less complete sets of back numbers on the shelves. Large collections of specimens and mounts in the various branches of biology are being constantly added to, making important adjuncts to the class and laboratory work in these subjects.

(1) **Invertebrate Zoology.**—Devoted to the study of the invertebrate animals, including their morphology, development, habits, economic or popular interest and classification. The broad biological principles are brought out and emphasized. The class room work is based on Hegner's "Introduction to Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of animals. Required of agriculture, home economics and biology students. Lectures, 2; laboratory, 2. I, 4. Assistant Professor Spaulding.

(2) **Vertebrate Zoology.**—Lectures and laboratory work reviewing the vertebrate (chordate) animals, treating in detail the structure and relationships of the different groups; their classification and economic importance. Special attention is given to birds and mammals. Prerequisite: Biology (1). Elective to biology and other students. Will be taught once a year either semester. Lectures, 2; laboratory, 2. I or II, 4. Assistant Professor Spaulding.

(3) **Animal Physiology and Anatomy.**—By means of lectures and

demonstrations the main principles of human physiology are presented to the students, while in the laboratory they become familiar with the most important features of mammalian anatomy. Required of agriculture, home economics and biology students. Prerequisite: Biol. (1). Lectures, 3; laboratory, 2. II, 5. Assistant Professor Spaulding.

(4) **Economic Entomology.**—Lectures on the anatomy, metamorphosis and classification of insects; a study of the various orders and of the principle families with particular reference to the species of economic importance; a field and insectary study of a few selected life histories; collecting, mounting and preserving insects. Prerequisite: Biology, (1). Required of agriculture and biology students. Lectures, 3; laboratory, 2. I, 5. Professor Cooley.

(5) **General and Systematic Entomology.**—A consideration of the principles of classification; a more detailed study of the anatomy and physiology; development; insect adaptations; insects in relation to plants; interrelations of insects; transmission of diseases by insects. A laboratory study of the external anatomy of representatives of the more important orders; external anatomy of larvae, pupae and nymphs; classification to the family in the more important orders; identifying to the species in selected groups. Prerequisite: Biology (4). Lectures, 2; laboratory, 2. I, 4. Professor Cooley.

(6) **Advanced Economic Entomology.**—A detailed consideration of the more important insect pests together with a study of the principles of insect control, including insecticides and insecticide appliances. Laboratory work on economic species and insecticides and library work on the literature of economic entomology. Prerequisite: Biology (4). Lectures, 3; laboratory, 1. II, 4. Professor Cooley.

(7) **Advanced Entomology.**—Instruction in this course is largely individual and is arranged with particular reference to the needs of each pupil. In general the work includes one or more of the following; a systematic and biological study of a particular group; an economic study of injurious species; thesis on a selected topic; a problem; a literature search; an experiment; a life history study; anatomical study. Prerequisites: Biol. (4), (5), and (6). I and II, 6 to 10. Professor Cooley.

(8) **Household Entomology.**—Lectures on insect pests of the household and a consideration of insects as carriers of common diseases. Lectures, 2. II, 2. Professor Cooley.

(9) **General Botany.**—Morphology, anatomy and elementary physiology of plants, including life history studies of all the groups. The fundamental biological principles are here laid down on which all higher botanical studies are based. Required of all biology and agriculture students. Lectures, 3; laboratory, 2. I, 5. Professor Swingle and Assistant Professor Jennison.

(10) **Plant Physiology.**—Lectures and experimental work on nutrition, growth, reproduction and movement in plants, especially the higher forms. Especial attention is given in the laboratory to methods most generally used in the study of plant functions. The last part of



the semester is devoted to a brief study of the physiology of the higher plants in preparation for agricultural subjects and the classification of the families containing most of our crop plants. Prerequisites: Biology (9), Physics (1a) and chemistry (5). Required of biology, agronomy and horticulture students. Lectures, 1; laboratory, 3. II, 4. Professor Swingle and Assistant Professor Jennison.

(11) **Plant Pathology.**—General facts and principles governing the health and disease of plants, with illustrative experiments, followed by a study of the classification, morphology, and special physiology of parasitic plants, with especial reference to diseases of cultivated crops in Montana. Prerequisites: Biology (9) and (12). Required of agronomy and horticulture students. Lectures, 1; laboratory, 3. II, 4.

(12) **Bacteriology.**—A study of the structure, life history and classification of bacteria, their growth in nutrient media, and methods of bacteriological technique. The relation of bacteria to agriculture, disease, and our daily life is discussed. Prerequisites: Biology (9) or (3) and chemistry (1). Required of agriculture and home economics students. Lectures, 2; laboratory, 3. I, 5.

(13) **Embryology.**—An introductory course in embryology, embracing a study of the foundation and growth of tissues in the vertebrate body, based chiefly on a study of the chick, but including consideration of the development in the mammalia. Open to students who have completed biology (2) or (3). Lectures, 1; laboratory, 3. I, 4.

(14) **Organic Evolution.**—A lecture course treating of the different evolution theories and their present status; will also include such topics as the origin of species, heredity, variation, natural and artificial selection, adaptations, etc. Lectures and assigned reading. Required of agriculture and biology students and elective to students who have completed at least two courses in biology. Lectures, 3. II, 3.

(15) **Thesis.**—Students in the biology course in their senior year and seniors from other courses, who have had sufficient previous training in biology, may devote a maximum of five credits per semester to thesis work, under the direction of Professors Cooley or Swingle, or Assistant Professor Spaulding.

(16) **Sanitary Bacteriology.**—This course deals briefly with moulds and more extensively with bacteria in relation to health in the human race. It treats of infectious diseases, especially from the standpoint of their prevention. A knowledge of the sources and modes of infection for self protection and the protection of others is the central idea. Prerequisite: Biology (12). Lectures, 2. II, 2. Professor Swingle.

(17) **Systematic Botany.**—This course deals strictly with classification of the flowering plants. The principles of classification are laid down in the lecture room, and laboratory and herbarium work, and field excursions serve to familiarize the student with principle orders and more important genera. Especial attention is given to the families of greatest economic importance including the grasses. Required of biology students and elective to others. Prerequisite: Biology (9). Lectures, 1; laboratory, 1 to 3. I, 2 to 4.

## CHEMISTRY.

Professor Cobleigh.  
Assitant Professor Barnes.  
Mr. Weatherhead.  
Mr. Gottschalck.

The applications of chemistry to the various phases of agriculture, to engineering and to many modern industries, make this science an important one in a technical school. The fundamental courses of the science should be thoroughly taught in order that the student may have sufficient training and independence to apply his knowledge to practical operations. If the student is to master the principles of chemistry and at the same time obtain a working and practical knowledge of chemical manipulation, he must have certain facilities at his disposal.

Below is given somewhat in detail, a description of the equipment and the conveniences provided for the study of chemistry, in this institution:

The lecture room, with raised floor and seating capacity for one hundred and fifty students, has a lecture desk provided with water, gas, and electricity, a demonstration balance and stereopticon for showing the applications of the science. The class room exercises in general and applied chemistry are illustrated by experiments, lantern slides, and in many cases by exhibits of the raw materials and finished products of commercial processes. The lecture room equipment is in an adjoining room, which also serves as a private laboratory.

There are five laboratories equipped for the following work: General chemistry, qualitative and quantitative analysis, organic and food chemistry, physical chemistry, and assaying. All desks are provided with water, gas, electricity and filter pumps when needed. The hoods in each laboratory are furnished with gas and water and connections from a large Parson's hydrogen sulphide generator, which will supply forty jets at one time. In each hood there are large steam and air baths in operation at all times, being connected to the steam heating plant. The building is well ventilated by means of a mechanical draft, and heated by a direct-indirect steam system. With some of the classes working in sections the laboratories will accommodate one hundred and fifty students.

The store room is stocked with an ample supply of apparatus and chemicals needed for the various laboratory courses. The student secures what equipment he needs from time to time, in addition to that always kept in his desk, from the storekeeper, who is on duty at convenient and stated hours. The equipment includes, besides the usual stock of apparatus, much that is designed for special use, such as accurate balances for both quantitative analysis and assaying, standard weights, equipment for calibrating measuring apparatus, polariscopes, Abbe refractometer, oil testers, apparatus for water, air,

and gas analysis, combustion furnaces, Hoskin's crucible and muffle furnaces for experiments necessitating high temperatures, apparatus for gas density determinations, Beckman's freezing and boiling point apparatus, and equipment for conductivity measurements, etc.

The department museum occupies a well lighted room in the basement. In this room are stored in cabinets, and glass exhibit cases, the collections illustrating chemical industries of various kinds, and the mineralogical and geological specimens. The mineral collection is quite extensive. It includes a valuable private collection purchased by the college some years ago. To this was added a part of the Montana mineral exhibit at Chicago in 1893, and large additions have been made from time to time through exchanges and purchases. The collection is thoroughly representative and forms an important adjunct to the chemical department.

The chemical library and office is located on the first floor and contains full sets of the American Journal of Science, Journal of the American Chemical Society, Journal of the (London) Chemical Society, Berzelius Jahresbericht, Bericht der deutschen Chemischen Gesellschaft, and Fresenius Zeitschrift fur Analytische Chemie. There are also partial sets of Chemical News and the Analyst. Besides these the library contains many standard reference works and the recent text books. There are also index volumes and card catalogues to facilitate more ready reference to the literature.

(1) **General Chemistry.**—Two lectures, one recitation and  $2\frac{1}{2}$  hour laboratory period per week throughout the year on the fundamental laws of chemistry, the history, occurrence, preparation and properties of the common elements and their compounds. Text books: **General Chemistry**, by Kahlenberg, and laboratory notes prepared by instructors in the department. Lectures, 2; quizzes, 1; laboratory, 1. I and II, 8.

(2) **Qualitative Analysis.**—Lectures and recitations two hours per week on the theory and practice of qualitative analysis. Laboratory practice two afternoons per week in the analysis of simple salts, complex mixtures, ores and minerals. Prerequisite: Chemistry (1). Text book: **Qualitative Analysis**, by Baskerville and Curtman. I, 4.

(3) **Quantitative Analysis.**—Lectures and recitations on the theory and technique of the laboratory methods and chemical calculations. The analyses required in the course includes the following: Magnesium sulphate, potassium alum, iron ammonium alum, iron ore, limestone, clay or slag, zinc, lead, copper, manganese, arsenic, antimony, and nickel ores alkalimetry, acidimetry, and iodimetry. Prerequisite: Chemistry (1) and (2). Text books: **Miller's Notes on Quantitative Analysis for Mining Engineers**; **Treadwell's Quantitative Analysis**; and **Miller's Calculations of Analytical Chemistry**. I, 5; and II, 2 or 4.

(4) **Organic Analysis.**—Lectures and recitations on the methods used for the analysis of organic substances and agricultural products. The laboratory portion of the course includes the analysis of the following: Feeding stuffs and cereals, fertilizers, soil, sugar, milk, butter, oils,



alcohol, glycerol, formaldehyde and the detection of adulterations in food. Prerequisites: Chemistry (3) and (5). Text book: Proximate Organic Analysis by Sherman. I and II, 8.

(5) **Organic Chemistry.**—An elementary course designed to make the student familiar with the principles of organic chemistry and with the more important compounds of both the aliphatic and aromatic series. Remsen's Organic Chemistry is used in the class room and the laboratory work is based on Orndorff's Laboratory Manual, and Gatterman's Practical Methods of Organic Chemistry. Prerequisites: Chemistry (1) and (2). II, 5.

(6) **Advanced Inorganic Chemistry.**—Lectures and recitations on general theoretical chemistry in which special attention is given to the study of the elements according to the periodic classification of Mendeleef. Prerequisites: Chemistry (1), (2), and (5). I and II, 6.

(7) **Agricultural Chemistry.**—This course is designed especially to meet the needs of the students in the four-year course in agriculture. Lectures and recitations on the chemistry of soil, manures and fertilizers. The laboratory work includes the following analyses: Magnesium sulphate, potassium alum, iron and ammonium alum, limestone and soil. Text books: Ingle's Manual of Agricultural Chemistry; Lincoln and Walton's Quantitative Analysis for Agricultural Students. Prerequisites: Chemistry (2) and (5). I, 4, and II, 2 or 4.

(8) **Organic and Food Chemistry.**—This course is especially designed for students in the sophomore year of the home economics course. The first twelve weeks are devoted to the study of pure organic chemistry, both in the class room and in the laboratory. The next twelve weeks are devoted to the study of qualitative analysis. Substances of household interest and importance are analyzed and their uses discussed. These two divisions of the course give the fundamental knowledge necessary for the last twelve weeks of the course, which are devoted to the study of the composition of foods, their manufacture, preservation and adulteration. Prerequisite: Chemistry (1). Text books: Outlines of Organic Chemistry by Moore; Qualitative Analysis by Baskerville and Curtman, and Sanitary and Applied Chemistry by Bailey. I, 4 or 5, and II, 3 or 4.

(11) **Food and Nutrition.**—Lectures on the functions of fats, carbohydrates, protein and salts in nutrition, together with a study of the chemistry of digestion and metabolism. Lectures on food production, and preservation, food legislation, and inspection. Prerequisites: Chemistry (5) or (8) and biology (3). Text book: Chemistry of Food and Nutrition, by Sherman. II, 3.

(13) **Chemical Factory Machinery.**—This is an introductory course in industrial chemistry. Lectures are given on the types of machinery used in carrying on chemical processes. Attention is given to the general operations common to many industries such as crushing, grinding, calcination, fusion, distillation, filtration, crystallization, etc. The course also includes lectures on the production of iron, steel and copper. Prerequisite: Chemistry (3) first semester. II, 3.

(14) **Industrial Chemistry.**—This is a course which treats by means of lectures and laboratory exercises some of the more important technical chemical processes. The topics considered are the following: Lime, mortar, cement, refractory materials, glass, fertilizers, explosives, alkalis, acids, paints, pigments, soap, sugar, paper, etc. The lectures are illustrated by charts, models, lantern slides, and museum specimens of raw materials and finished products. The laboratory exercises are selected to supplement the lecture work and are taught from the standpoint of chemical engineering. Inspections and reports on the various industrial plants in the state are required in the course. Prerequisites: Chemistry, (3) and (13). I, 5, II, 2.

(17) **Fuel Analysis.**—This is a course in the production and analysis of solid, liquid and gaseous fuels, illuminating gas, and lubricating oils. Prerequisite: Chemistry, (3) first semester. II, 3.

(18) **Water Analysis.**—Lectures and laboratory practice in the chemical examination of potable waters, of water for industrial purposes and steam raising, of sewages, and of air. Lectures on water purification and softening, and sewage treatment, and also the interpretation of water analyses. Prerequisites: Chemistry (1), (2) and first semester of Chemistry (3). II, 4.

(19) **Physical Chemistry.**—A course in theoretical chemistry consisting of lectures, recitations, assigned problems, and laboratory work. The discussions include the following topics: The gas laws, thermodynamics, solutions, chemical mechanics, equilibrium in electrolytes, and electro-chemistry. Prerequisite: Chemistry (3). Text book: Morgan's Physical Chemistry for Electrical Engineers. I, 4.

(20) **Seminar.**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors where the topics are freely discussed. Students are thus kept in touch with the progress of the science. I and II, 2.

(21) **Thesis.**—Students in the chemistry course may in the senior year prepare a graduate thesis on some subject which will involve considerable laboratory work and as much originality as possible. I and II, 4.

#### ENGLISH.

Professor Brewer.

Dean Herrick.

Assistant Professor Gilruth.

The library has abundant equipment for all the work offered in English. There are complete standard texts of practically all the authors referred to in any of the courses. Besides these there is a fair supply of biographical, critical and historical works, sufficient for ordinary reference use. The library equipment is complete enough so



that thus far students have been able to do the reading assigned without the necessity of purchasing many books.

Though many classic novels are to be found on the shelves, no effort has been made in the college library to provide current fiction.

In all the courses in English, written work plays an important part. That this work may be kept up to the proper grade, it is announced here that in college English work no paper will receive any credit that shows notable carelessness or ignorance in elementary matters of punctuation, grammar, rhetoric, or in the spelling of common words.

(1) **English Composition.**—The course is required of all freshmen. The course is almost altogether practice in various types of prose composition; narration, description, exposition, criticism, and argumentation. The class meets ordinarily twice a week. The instructor from time to time meets each student for private conference about his work. Lectures. I and II, 4. Mr. Gilruth.

(2) **Expository Composition.**—This is a course primarily in expository writing and intended for students who will go into scientific or technical work. Papers prepared in scientific or technical courses, if not too technical, may be handed in as part of the work of this course. The year's work may also include some practice in business correspondence and in argumentative writing in preparation for English (5). I and II, 4. Prof. Brewer.

(4) **Public Speaking.**—Informal lectures. Extemporaneous speaking and training in the writing of the different forms of public discourse. The course will close with a study of the essential principles of debating; each student will be required to take part in at least one debate. Required of all freshmen. I and II, 2. Mr. Gilruth.

(5) **Argumentation and Debating.**—Study of the principles of argumentation and master pieces of forensic oratory. Preparation of briefs and forensics. Conferences, lectures, debates and other forms of public address. Elective for seniors and juniors who have credit for courses (1), (2) and (4). I and II, 4. Mr. Gilruth.

(6) **Interpretive Reading.**—This course will include work in the cultivation of the voice and the study of gesture, together with a large amount of drill in interpretive reading from standard literature, both prose and poetry, and especially in oratory and the drama. It is intended for those who expect to take part in oratorical or declamatory contests, and in college plays. It is elective for sophomores, juniors and seniors. Prerequisites: English (1) and English (4). With the consent of the instructor, it may be taken in the first half-year separately. I and II, 4. Mrs. Herrick.

(10) **English Literature.**—A reading course in English literature including about twenty of the more important authors. A large amount of reading is required and more recommended. Written reports on the reading are frequently required. A part of the class room time is given to critical reading of English masterpieces. Lectures, recitations, and conferences. I and II, 4. Prof. Brewer.

(11) **English Essayists of the Nineteenth Century.**—A study of the more important essayists from Charles Lamb to R. L. Stevenson. Lectures and recitations. I and II, 4. Prof. Brewer.

(12) **Shakespeare.**—A careful reading of three plays in the class room, and outside reading in other plays of the period. Lectures and recitations. II, 4. Prof. Brewer.

(13) **Victorian Poetry.**—A study of the poetry of the Victorian period, with special reference to the work of Alfred Tennyson, Robert Browning, and Matthew Arnold. Lectures and recitations. I and II, 4. Prof. Brewer.

Course 10 is given every year and is prerequisite to courses 11-13. Courses 11-13 are not all given in the same year. Classes will be organized when a sufficient number of students elect any course.

### FRENCH AND SPANISH.

Miss Wallin.

(1) **French.**—First year's work includes elements of grammar based on Fraser and Squairs' French Grammar, with constant practice in pronunciation, dictation, and conversation. Reading of easy texts I and II, 8.

(2) **French.**—Review of grammar. Typical fiction and dramas of the nineteenth century are studied. Advanced composition and original theme writing. Conversation and dictation. I and II, 8.

(3) **French.**—Study of classic French literature of the seventeenth and eighteenth centuries, such as Corneille, Racine, Moliere, LeSage and Voltaire. Collateral reading and reports. Lyric poetry. I and II, 6 or 8.

(20) **Spanish.**—Hill and Ford's Grammar, reading, composition. Much attention is given to pronunciation. Reading of such texts as Valera's *El Pajaro Verde*, Alarcon's *El Sombrero de Tres Picos*, and Moratin's *El si de las Ninas*. I and II, 8.

### GERMAN.

Assitant Professor Cehrs.

(10) **German.**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes pronunciation, grammar, selections in prose and verse, with practice in speaking and writing German. I and II, 8.

(11) **German.**—A continuation of the above course. The work consists of reading of texts suitable for second year work; for the most part, the writings of contemporary authors. Memorizing of easy colloquial sentences and poems. Conversation and composition. An effort is made to familiarize the student with the customs, life and spirit of the German people. I and II, 8.

(12) **German.**—This course, open to freshmen, is a continuation of the course offered in the preparatory department, and can be taken

only by students who have had two years of German previously. The classics will be studied; also scientific texts if desired. Conversation and composition. I and II, 8.

(13) **German.**—An elective course offered to those who have completed course (11) and (12). It consists chiefly of advanced reading of a practical, scientific or literary character, as the needs of the students electing it may dictate. I and II, 8.

## GEOLOGY.

Assistant Professor Barnes.

The subjects of mineralogy and geology are important not only to the student of general science, but also to those who are specializing along some particular applied line. Here the student of agriculture gains an insight into the nature of soil as merely one particular phase of the broader subjects of rock formation, and disintegration, and from his knowledge of rocks, rock forming minerals, and the changes which these minerals undergo gains the ability to classify soils in a systematic manner. The engineer is enabled both to distinguish between the various types of rocks and minerals, and also to foresee how a given constructive material will withstand various conditions of weathering, and other destructive agents. The science student, in any field, finds in geology and mineralogy a history of the nature and origin of all the materials with which he comes in contact, and having command of such data he approaches his subject in a well prepared and intelligent manner.

The aim of the work in geology is to give the student a comprehensive view of the science as a whole. While geological processes and their results are given considerable attention, other phases of the subject are not entirely neglected. Thus the course also includes a brief discussion of the principal types of rocks and rock minerals; as well as a number of the more important applications of economic geology, especially in connection with the origin of some of our more important ore bodies. The work closes with a consideration of some of the later theories in regard to the earth's formation, and a brief review of the earlier stages of the planet's history.

The department museum, containing an excellent collection of minerals, rocks, and fossils, is constantly drawn upon for illustrative material. In addition, the publications of the United States Geological Survey are at the command of the student, and are used as references in connection with special topics. A set of lantern slides is used for illustrating many of the lectures. Besides the class room work a number of field trips are taken by the class, where the action of geological forces in the past is pointed out and studied. The college is located in an excellent region for this field study, and many interesting phases of the subject are presented close at hand. The field

work is concluded with a one-day trip to Morrison Cave, a very interesting formation lying about fifty miles west of Bozeman.

(1) **Geology.**—Lectures, recitations, and assigned reading in dynamic and structural geology. Text: Blackwelder and Barrows. Elementary Geology. Prerequisite: Chemistry (1). II, 3.

(2) **Mineralogy.**—Lectures and laboratory instruction in crystallography, hand specimen identification, blow pipe analysis, and determinative mineralogy. Text: Moses and Parson's Mineralogy. Prerequisite: Chemistry (1) and (2). I, 4.

### HOME ECONOMICS.

Professor Harkins.

Assistant Professor Ballinger.

Miss Hunt.

The third floor of the agricultural building is occupied by the home economics department. At the north are two kitchen laboratories, on either side of the hall. One laboratory, 34x26 feet, has two coal ranges, electric stoves and desks for twenty-four students. The other, 27x26 feet, has one coal range and fourteen desks, fitted with individual gas stoves. All tables are well supplied with cooking utensils. Adjoining the east kitchen is a dining room, and beyond it the department office. There are also store rooms, pantries and cold storage rooms.

In the south end of the building two large sewing rooms, two small fitting rooms, and cases for the work of one hundred and forty students. The department has nine sewing machines of various makes, electric irons, cases for exhibition work, looms for rug weaving, and large and small work tables.

(1) **Principles of Cookery.**—This work includes both lecture and laboratory work on the composition and preparation of foods. Lectures on marketing and care of food materials. The object of the course is to teach plain cooking based upon scientific principles. Lecture, 1; laboratory, 3. II, 4.

(2) **Food Studies.**—This course is designed to make practical application of the science underlying the selection and preparation of foods. The dishes prepared illustrate the scientific principles involved. Prerequisites: Home economics (1); chemistry (1) and (5). Lecture, 2; laboratory, 2. II, 4.

(3) **Home Architecture, Decoration and Sanitation.**—Evolution of the home, modern houses; site, surroundings, construction, heating, fighting, plumbing and drainage. Practice in drawing floor plans of houses. Lectures on the history of furniture, floor coverings and wall hangings, economic problems in house furnishings. I, 2.

(4) **Advanced Cooking.**—In this course menus are planned and meals prepared. The student has instruction in the making of a few



difficult and fancy dishes. Prerequisites: Home economics (1) and (2), Laboratory, 2. I, 2.

(5) **Advanced Food Studies.**—This course continues the work outlined in home economics (2), taking up a more detailed study of the food principles and correlating closely with the work in bacteriology, physics, chemistry, biology and physiology. Prerequisites: H. E. (6); chemistry (11); biology, (12), and physics (9). I, 2.

(6) **Dietetics.**—This course treats of the fundamental principles of human nutrition and metabolism, the relation of food to health and disease, and the construction and preparation of dietaries. Prerequisites: Home economics (2); chemistry (5); biology (12). Lectures, 2; laboratory, 2. I, 4.

(7) **Household Management.**—Organization of the household; expenditure of income; education for the home; household accounting; care of the house and other essentials of a well ordered home. Lectures on home nursing by a trained nurse. II, 3.

(8) **Teachers' Course.**—In this course both the theory and practice of teaching domestic science is given. A study is made of the courses of study in various institutions. Courses of study are planned for graded schools, high schools, and colleges. Each student has work in practice teaching. Prerequisites: Home Economics (3), (4), (5), (6) and (7). Lectures, 2; laboratory, 1. II, 3.

(9) **Seminar.**—A study of the various phases of home economics. In this course the student prepares at least three papers on some home economics problem; it is then discussed by the class. I, 2.

(10) **Home Problems and Demonstrations.**—Individual problems in food work or economic problems connected with the home. May be taken either semester. This will depend upon the subject chosen. 3 to 4.

(11) **Elementary Clothing.**—The fundamental principles of hand and machine sewing applied to the making of aprons and undergarments. Taking measurements, drafting, use of patterns and computation of cost. The drafting system and apron materials are included in the fee. Other materials provided by the student, subject to approval of instructor. Finished garments are the property of the student. I, 3.

(12) **Dressmaking.**—A course in sewing applied to the making of shirtwaists and simple cotton dresses. Designing and drafting patterns. Computation of costs. I, 2.

(13) **Textiles.**—This course comprises a study of fabrics, beginning with their place in primitive life and tracing their development, manufacture, and economic value up to the present time. Prerequisites: Chemistry (1); home economics (11) and (12). I, 3.

(14) **Advanced Dressmaking.**—This course includes the making of a woolen dress or suit and a dress for afternoon or evening wear. II, 3.

(15) **The Teaching of Domestic Art.**—Fine hand sewing and its application to garments chosen as problems in a sewing course; lesson



plans, courses of study and equipment. Prerequisites: Home economics (11), (12), (13) and (14). I, 2.

(16) **Embroidery.**—This course deals with the principal stitches used in decorative art. The decoration of household linens, undergarments and dresses is given attention. II, 2.

(18) **Special Credits.**—Students who have practiced teaching in the Bozeman public schools or in the college will be allowed credits (not to exceed 2) for this work.

## HISTORY.

Assistant Professor Brewer.

The department has a set of MacCoun's historical charts of the United States and two sets of historical geography charts of Europe by the same author; Johnston's series of maps of ancient geography; ten of Breitschneider's maps of medieval Europe; and a set of maps of the modern world.

The library contains the laboratory of the historical department, but a catalogue of the histories would be too voluminous to include here. In Greek and Roman history, besides the standard narrative works, there are translations of the best source material for this period. For English history the library is well equipped with general works and has source material including Colby, Lee and the University of Pennsylvania collection, Evelyn's Diary, a file of "The Gentleman's Magazine," etc.

Naturally the works on the United States history are the most numerous. The standard general histories, as well as works on limited periods or regions, and the best biographies of American statesmen, are in the library. The reports of the American Historical Association, and the Congressional Records, come to the library. There are also many contemporary records, among which are the Old South Leaflets, Hart's American History Told by Contemporaries; the complete works of Jefferson, Hamilton and other statesmen, and the Jesuit Relations.

The works on industrial history are more recent; and works on the development of our own industrial and commercial life are constantly being added to the equipment of the department.

A reflectoscope is installed in the class room, which is at all times available for showing pictures of historic scenes and objects. A large number of views belonging to the teacher are used in all classes.

(1) **English History.**—It is taken for granted that the student has had a preparatory course in general history, with some such text as Myers or West. In this course study of the text book is supplemented by lectures on the English constitution and on the development of continental Europe. Special topics with library references are assigned to the student in addition to the text. I and II, 6.

(2) **Medieval History.**—The student is supposed to have had

courses which have given him knowledge of the great epochs in history and their relation to each other. Therefore, in this course he will take up the thorough history of one period. In this connection the student has an opportunity to study the art development of the period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available. I and II, 6. (The Renaissance in Italy, given in 1914-15.)

(5) **American History.**—This is a course in United States history covering the period of constitutional development and with special reference to that development. The use of the library rather than of any text book is required in this course, and the student is expected to spend about one-fourth of the time in the preparation of a paper on some selected subject. Course (1) should precede this course. I and II, 6.

(7) **Modern History.**—A short course in recent history will be offered to freshmen. The object will be to give them a more intelligent interest in current events by a review of the political and industrial development of the last few decades. I, 4.

(10) **Industrial History.**—English history (1) and knowledge of the outlines of United States political history is required for this course. Coman's Industrial History of the United States is used as the basis for work. Each semester the student will write a paper on some special line of industry which he either reads or personally investigates. Lectures on related subjects will supplement the student's work. I and II, 6.

## MATHEMATICS.

Professor Tallman.

Miss Bull.

The students in this department have access to the following journals: American Journal of Mathematics (complete set); Annals of Mathematics (from 1900); Bulletin of American Mathematical Society (1898 to date); also about 200 volumes of recent treatises on mathematics. It may also be mentioned that our library is especially well equipped with treatises and journals of applied mathematics found in the libraries of the engineering and physics departments.

(1) **Algebra.**—Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and groups, binominal theorem, theory of limits, undetermined co-efficients, logarithms and an introduction to the theory of equations. I, 3.

(2) **Plane Trigonometry.**—For engineering and science students. I, 2.

(2a) **Plane Trigonometry and Logarithms.**—For agricultural and home economics students. I, 3.

(3) **Analytical Geometry and Calculus.**—This course includes the

geometry of the straight line and conic section coupled with the elements of differential calculus. II, 4.

(4) **Analytical Geometry and Calculus (continued).**—This course which deals largely with the differential and integral calculus also takes up some problems in analytical geometry not treated in course (3), especially the geometry of three dimensions and also includes an introduction to differential equations. I and II, 10.

(5) **Methods of Least Squares.**—I, 2.

(6) **Theoretical Astronomy.**—Integration of equations of motion, computation of orbits and ephemerides. This course should be preceded by course (5) in physics and must be preceded by course (4) in mathematics. I and II, 6.

(7) **Applied Algebra.**—This course is designed for students who do not expect to go further into the study of mathematics. Starting with a review of some of the fundamentals of elementary algebra the course deals with such subjects as ratio and proportion, mathematical inductions, probable results and errors from experimental data, etc., as will assist the students in their scientific work. For agricultural and home economics students. II, 2.

(10) **Differential Equations.**—Ordinary and partial differential equations with geometrical and mechanical applications. I and II, 6.

(11) **Partial Differential Equations of Mathematics-Physics.**—This course will be based on Weber's "Die Partiellen Differential Gleichungen der Mathematischen Physik," and Byerley's "Spherical Harmonics." A great many applications to concrete problems will be made throughout the course. I and II, 6.

(12) **Newtonian Potential.**—Lectures on the theory of potential, with an introduction to spherical harmonics. I and II, 4.

(13) **Algebra (Advanced).**—This course will be an extension of course (1). and will contain discussion of complex numbers, theory of algebraic functions, etc. Care will be taken to show the practical application of each subject as the work advances; that is, such subjects as the connection between complex numbers and alternating currents, etc., will be fully explained. I and II, 6.

(14) **Analytical Geometry (Advanced).**—This course is a continuation of course (4). As the time given in course (4) for geometry of three dimensions is very limited it will receive considerable attention in this course. I and II, 6.

(15) **Thesis.**—Students specializing in mathematics are required to present a thesis on some chosen subject. This subject must be chosen and approved not later than November 15 of the senior year. A great deal of work in this line is desired, as it is believed there is no better way of developing a habit of independent thought.

Only a selection of courses (10) to (14) will be given each year, those being chosen for which most students apply. The special object of our work here is to make the course in applied mathematics complete, and the work in pure mathematics will have as its object the laying of a good foundation for the more advanced work in applied

mathematics. Those desiring to do work which is not offered in the above courses may consult the professor in charge of the department.

## PSYCHOLOGY AND ECONOMICS.

President Hamilton.

(1) **Psychology.**—This course presents a general view of modern psychology and is required of all general science students. It gives a practical exposition of the materials and methods of psychological investigation. The lectures are accompanied by class demonstrations. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training, the higher intellectual faculties and the will. So far as possible the work is made practical and concrete. I, 3.

(3) **Economics.**—This course consists of a study of such subjects as land, capital, labor, money, coinage, banking, rent, interest, wages, and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, cooperation, recent currency legislation, and the single tax. I and II, 4.

(4) **Sociology.**—The origin and history of human society, the various social theories and the laws of human intercourse are treated. Attention is given to such practical subjects as the government of cities, settlement work, the enrichment of country life, and charity work. Lectures and recitations. Elective. II, 3.

(5) **Advanced Economics.**—A study of the organizations, relations and problems of labor and capital; monetary systems and methods of banking; systems of taxation and sources of revenue; public expenditures. I and II, 6.

## PHYSICS.

Professor Ham.

Mr. Haines.

The following courses in physics are designed to meet the needs of (1) those students who are preparing to take up some of the more technical studies in engineering or agriculture, (2) those who expect to become physics or science teachers, and (3) those general science students who wish to acquire some of that kind of scientific training which is peculiar to the science of physics alone.

The facilities at the disposal of the physics department are described below somewhat in detail.

The lecture room is located in the basement of the chemistry and physics building. The lecture desk is supplied with gas and both alternating and direct current circuits. A projection lantern is permanently set up and is used constantly to illustrate the class room exercises.



A large collection of lantern slides has been prepared, which cover the whole subject of physics. The apparatus for lecture demonstration has been carefully selected and is sufficiently complete for giving experimental illustrations of all the principles of the science that are usually included in college courses.

For laboratory instruction three well lighted and conveniently furnished rooms are provided on the second floor of the building.

One of these rooms is equipped for electrical measurements and is wired with both alternating and direct current circuits, conveniently arranged for experimental purposes. The galvanometers are permanently located in convenient positions. The following forms are available: Tangent, astatic, Thompson, differential, Northrup, and eight forms of the D'Arsonval type, including three with ballistic suspensions. In addition to the above equipment the following instruments are used in the various experiments taught, viz: magnetometer, standard resistance and condenser, an air condenser for determining the ratio of the electrostatic to the electromagnetic units, Carhart-Clark cells, wire and box forms of the Wheatstone bridge, Carey Foster bridge, Callendar and Griffith's bridge, rheometer, electro-dynamometer, ammeters, voltmeters, Lead's potentiometer, platinum thermometer, thermocouples, earth inductor, standard solenoid, Thompson integrating wattmeter and a permeameter with ten different specimens of iron for experiments in magnetization and hysteresis.

The second laboratory is furnished and equipped for teaching mechanics and heat. The equipment includes the following: micrometer and vernier gauges, spherometer, cathetometer, balances and weights, hydrometers, Atwood's machine, Young's modulus apparatus, torsion apparatus, torsion pendulums, apparatus for resolution and composition of forces, impact, harmonic motion, principle of moments, centrifugal force, and surface tension; simple and Kater's pendulums, a laboratory clock, thermometers, air thermometer, calorimeters, expansion apparatus, hygrometers, Searle's mechanical equivalent of heat apparatus.

The third laboratory is used for the study of light and sound and also for the elementary classes in the preparatory school. The equipment for teaching light and sound includes the following: a photometer, spectrometer, spectroscope, mirrors, prisms, lenses, diffraction gratings, optical bench, Fresnel mirror and bi-prism, apparatus for polarized light, microscope, telescope and an Abbe refractometer, sonometers, Kundt's tubes, siren, Lissajous apparatus, and Helmholtz resonators.

For the study of radioactivity and allied phenomena, there is a large induction coil, a variety of Crookes' and X-ray tubes, Wilson electroscope, radium compounds and other radio-active material.

The physics library is located in one of the laboratories for students' use. It contains many of the best books and general works on physics, and the current numbers of the Philosophical Magazine, the Physical Review, Science Abstracts, Section A, Bulletins of the Bureau of Standards, and School Science and Mathematics.

(1a) **Agricultural Physics.**—Two lectures and laboratory work



two and one-half or five hours per week in mechanics, heat, light and electricity. Special attention is given in this course to the study of such physical principles as those involved in the capillary action of soils, the osmotic action of plants, the movements of winds and moisture, the causes of the deposition of dew and the prevention of frost. Physics (1a) is prescribed in the courses in agriculture and biology. Prerequisites: Mathematics (2) or (2a), and physics (a) or its equivalent. Text books: General Physics, by Crew; Laboratory Course, by Sabine; Laboratory Physics, by Miller. I and II, 6 or 8.

(1) **Engineering Physics.**—Lectures, recitations, and assigned problems, three hours per week throughout the year on mechanics, heat, magnetism, and electricity. This course is more mathematical and technical than physics (1a) and is particularly designed to meet the needs of students in engineering. Students who have not completed the calculus, mathematics (4), are required to take it during the same year that physics (1) is taken. Text book: General Physics, by Hastings and Beach. I and II, 6.

(2) **Physical Measurements.**—A laboratory course designed to supplement physics (1). It is strictly quantitative and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to offer a training in making measurements of precision. Text books: Mechanics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. I and II, 4.

(3) **Light and Sound.**—Lectures and recitations two hours per week on wave motion, the theory of light in its application to familiar optical phenomena and to optical instruments, and on the phenomena and laws of sound. Prerequisites: Physics (1) and (2). Text book: Light and Sound, by Franklin & McNutt. II, 2.

(4) **Physical Measurements.**—A laboratory course in light and sound to supplement physics (3). II, 2.

(5) **Electricity and Magnetism.**—Two lectures and two laboratory periods per week on methods for the exact measurements of resistance, electromotive force, current, capacity, and the co-efficient of self-induction. The calibration of commercial instruments, insulation testing, and magnetic measurements, such as finding the permeability and the hysteresis effects of different samples of iron, will also be included in this course. Prerequisites: Physics (1) and (2) and differential and integral calculus. I, 4.

(6d) **Pedagogy of Physics.**—This course will be modified from year to year to suit the needs of the individual student. In general the course will include discussions of the methods of teaching, the selection and performance of effective lecture table and laboratory experiments and practice in presenting the topics covering such experiments to elementary and college classes. Prerequisites: Physics (1), (2), (3) and (4). I or II, 3.

(9) **Household Physics.**—This course is offered to students in the home economics course and to women in the other college courses who desire a better knowledge of the physics that is used in many of the

household operations. Special attention will be given in this course to the physics of ventilation, the lighting and heating of houses, the principles of electric, gas, and water meters, etc. Two lectures and one laboratory. I, 3.

(10) **Meteorology.**—This course is offered as an elective, particularly, to agricultural students who have had physics (1a) but is open to all who have had one course in college physics.

Topics such as air temperature, air pressure, winds, water vapor and its movement in the air, precipitation and its measurement, and a study of Montana weather conditions by means of weather bulletins will be made a part of this course. II, 3.

(11) **Electron Theory.**—This is primarily a graduate course of lectures but will be open to undergraduates who can satisfy the prerequisites. The course will not be a survey course but will take up some line of recent research work and investigate this in detail. Prerequisites: Calculus and at least fourteen credits of college physics. A knowledge of the methods of solution of some of the simpler differential equations and a reading knowledge of German are also desirable. II, 2.

### SECRETARIAL STUDIES.

Professor Brewer.  
Assistant Professor Gilruth.  
Miss Jones.  
Mr. Wilson.

The department is well equipped with typewriters, neostyle, duplicators, etc. The college and experiment station offices afford opportunity for extensive study of a wide range of office fixtures such as the dictographs, adding machines, filing cases, etc.

(1) **Shorthand.**—A thorough knowledge of the fundamental principles of shorthand practice in word building, phrasing and dictation. I and II, 8.

(2) **Shorthand.**—Additional drill in phrasing and word building. Practice in writing letters, legal papers, testimony, and miscellaneous matter, for the purpose of acquiring a large shorthand vocabulary. A speed of ninety to one hundred words a minute should be reached by the end of this year. I and II, 6.

(3) **Typewriting.**—Instruction in the use and care of typewriters. Exercise for the development of proper wrist and finger movements and for the mastery of the keyboard. Practice in letter writing and the use of carbon. I and II, 8.

(4) **Typewriting.**—Practice in transcribing from shorthand notes and from manuscript. Dictation for the attainment of speed and accuracy; also practice in the use of the mimeograph. I and II, 6.

(5) **Business Correspondence.**—A practice course in all forms of business correspondence. Attention is paid to spelling, punctuation,

paragraphing and the correct arrangement of materials, both as to form and language. II, 3.

(6) **Office Practice.**—Practice with the various kinds of office appliances and equipment, such as adding machines, duplicators, filing cases and card systems. Preparing copy for press and proof reading, typography and illustration. I, 4.

(7) **Business Methods.**—A practical course in business methods, including the principles of business organization and administration. How to do business with the postoffice, banks, railroads, express, etc. I, 4.

(8) **Commercial Law.**—A course in the principles of elementary business law. Students will be required to familiarize themselves with rights and liabilities growing out of the more common business relations. Principles governing the drawing and the validity of commercial paper will be emphasized. Text and occasional lectures by practicing attorneys. II, 3.

(9) **Principles of Accounting.**—The course deals with principles governing accounting. The aim of the course is to enable the student to understand the principles underlying all accounting rather than to confine him to a set system, but at the same time to enable him to quickly grasp the details of any system. I and II, 6.

(11) **Shorthand.**—A practical, advanced course; including special dictation practice for gaining additional speed. When possible opportunity will be given to assist in the actual work of an office. I and II, 4.

(12) **Typewriting.**—Rapid dictation. Additional practice in transcribing from shorthand notes, also copying work for gaining additional speed on the machine. I and II, 4.

## School of Home Economics and Mechanic Arts

The course in home economics is designed especially to fit young women to become home builders. For those who live on farms, work in gardening, poultry raising, dairying and plant culture is offered as elective.

The course in mechanic arts is designed principally for those who wish to do their own mechanical work on the farm, or to prepare themselves to become shop foremen, electricians, section bosses, engine men, firemen, contractors, traction engine men, draftsmen, etc.

For admission to these courses, the equivalent of an eighth grade certificate is required.

The large and well equipped science laboratories, drawing rooms, kitchen laboratories, sewing rooms and shops provide facilities for work that will rank with the best secondary polytechnic schools. The instruction is given by the regular faculty members in their special subjects.

### FOUR-YEAR COURSES.

The four-year courses in home economics and mechanic arts include the ten units required by the State Board of Education for admission to the freshman year of the state institutions as shown on page 18 of this catalogue. The remaining units consist for the most part of industrial subjects. A unit consists of work to the amount of four sixty-minute recitation periods per week for a year of thirty-six weeks. Two periods of laboratory, drawing, shop, cooking or sewing shall count as one recitation period. Irregular registration, except as necessitated by a student's previous preparation, is allowed by vote of the faculty only. The courses in English, German and mathematics may be taken only in the order tabulated in the courses.

Military drill is required of the boys and gymnasium practice of the girls in these courses.

Judge F. K. Armstrong of Bozeman gives a prize of ten dollars to the one taking first place in the annual declamatory contest. There is a prize of five dollars for the second best. Only regular students in the four-year courses are eligible to enter this contest.

Hon. Nelson Story, Jr., of Bozeman, gives twenty-five dollars for prizes in extemporaneous speaking. The contestants speak from five to eight minutes. The subjects are selected by them three hours before the contest from a list prepared by a committee of the faculty. Eligibility is the same as in the declamatory contest.

Those who complete the four-year courses in home economics and mechanic arts will be awarded suitable diplomas and are eligible to

enter the freshman class of the college. The young women who do not continue their studies will have a practical training which fits them for home making, and which furnishes an excellent preliminary training for the vocations based upon domestic science and art. The young men who can not continue their studies have a good preliminary training for drafting, the shop, the foundry, and work with steam and gas engines.

### THE TWO-YEAR COURSES.

Two-year courses are offered in home economics and mechanic arts. The entrance requirements are the same as for the four-year courses. Only students who have sufficient age and maturity to profit by the work are allowed to register in them. In order that there may be opportunity for specializing, a liberal amount of electives is allowed. The two-year courses contain all the industrial work of the four-year courses, together with English, German, history, mathematics and science. By specializing in one or two lines of work considerable proficiency may be gained and much progress made in the skill necessary to one of several vocations.



## HOME ECONOMICS.

## FIRST YEAR.

First Semester.		Second Semester.	
English Composition (Eng. a)	4	English Composition (Eng. a)	4
Algebra (Math. a)	4	Algebra (Math. a)	4
History (Hist. a or b)	4	History (Hist. a or b)	4
Textiles (H. E. c)	2	Drawing (Art a)	2
Sewing (H. E. a)	2	Sewing (H. E. a)	4
Drawing (Art a)	2	Physical Education	1
Physical Education	1		
	—		—
	19		19

## SECOND YEAR.

Rhetoric (Eng. b)	4	Rhetoric (Eng. b)	4
Plane Geometry (Math. c)	4	Plane Geometry (Math. c)	4
Biology (Biol. a)	4	Biology (Biol. c)	4
Cooking (H. E. g)	4	Cooking (H. E. g)	4
Drawing (Art a)	2	Drawing and Handicraft (Art b)	2
Physical Education	1	Physical Education	1
	—		—
	19		19

## THIRD YEAR.

Literature (Eng. c)	4	Literature (Eng. c)	4
Physics (Phys. a)	4	Physics (Phys. a)	4
German (German a)	4	German (German a)	4
Household Management (H. E. j)	2	Household Management (H. E. j)	2
Dressmaking (H. E. b)	2	Dressmaking (H. E. b)	4
Household Decoration (H. E. c)	2		
	—		—
	18		18

## FOURTH YEAR.

Literature (Eng. d)	4	Literature (Eng. d)	4
German (German b)	4	German (German b)	4
Elementary Food and Nutrition (H. E. h)	2	Elementary Food and Nutrition (H. E. h)	2
Algebra (Math. b)	4	Solid Geometry (Math. d)	4
Electives	3 or 4	Electives	3 or 4
	—		—
	17 or 18		17 or 18

List of electives for the above: Trigonometry (Math. 2a); Metal (Art 13); Basketry (H. E. 14); China Painting (Art 10); History (Hist. d); Embroidery (H. E. d); Vegetable Gardening (Hort. b); Landscape Gardening (Hort. d); Farm Dairying (A. I. f); Poultry (A. I. e); Music.

**HOME ECONOMICS.  
SHORT COURSE.  
FIRST YEAR.**

First Semester.		Second Semester.	
English Composition (Eng. a). 4		English Composition (Eng. a). 4	
Textiles (H. E. c)..... 2		Drawing (Art a)..... 2	
Sewing (H. E. a)..... 2		Sewing (H. E. a)..... 4	
Cooking (g) ..... 4		Cooking (H. E. g)..... 4	
Drawing (Art a)..... 2		Physical Education .. 1	
Physical Education ..... 1		Electives ..... 4	
Electives ..... 4			
—		—	
19		19	

**SECOND YEAR.**

Rhetoric (Eng. b) ..... 4	Rhetoric (Eng. b).. ..... 4
Biology (Biol. a)..... 4	Biology (Biol. a).... ..... 4
Household Management (H. E. j) ..... 2	Household Management (j).... 2
Sewing (H. E. a) ..... 4	Dressmaking (H. E. h)..... 4
Elementary Food and Nutrition (H. E. h) ..... 2	Physical Education ..... 1
Physical Education .... 1	Elective.. .... 4
Elective.... . 2	
—	—
19	19

Electives for the above: Trigonometry (Math. 2a); Metal (Art 13); Basketry (H. E. 14); China Painting (Art 10); History (Hist. d); Embroidery (H. E. d); Vegetable Gardening (Hort. b); Landscape Gardening (Hort. d); Farm Dairying (A. I. f); Poultry (A. I. e); Music.

**MECHANIC ARTS.****FIRST YEAR.**

## First Semester.

English Composition (a) .....	4
Algebra (a).....	4
Mechanical Drawing (l) .....	2
Woodwork (a) .....	4
General History (d).....	4
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## Second Semester.

English Composition (a) .....	4
Algebra (a) .....	4
Mechanical Drawing (l).....	2
Forge Work (b) .....	4
General History (d).....	4
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	18

**SECOND YEAR.**

Rhetoric (b) ....	4
Plane Geometry (c) .....	4
German (a) ....	4
Mechanical Drawing (m) .....	2
Pattern Work (e) .....	2
Foundry (d) ....	2
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	18

Rhetoric (b) ....	4
Plane Geometry (c).....	4
German (a).....	4
Mechanical Drawing (m) .....	2
Pattern Work (e) .....	2
Foundry (d).....	2
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	18

**THIRD YEAR.**

Literature (b) .....	4
Physics (a) .....	4
German (b).....	4
Mechanical Drawing (n) .....	2
Forge Work (c) .....	2
Machine Work (f) .....	2
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	18

Literature (c) .....	4
Physics (a).....	4
German (b) .....	4
Mechanical Drawing (n) .....	2
Machine Work (f) .....	4
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	18

**FOURTH YEAR.**

Literature (d) .....	4
Algebra (b).....	4
Mechanical Design (o) .....	4
Machine Work (h) .....	2
Steam Boilers and Engine (a) 4	
or Electrical Practice (a)...	4
or Industrial History (e)....	3
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	17 or 18

Literature (d) .....	4
Solid Geometry (d) .....	4
Mechanical Design (o) .....	4
Machine Work (h).....	2
Steam and Gas Engines (b)...	4
or Electrical Practice (a)....	4
or Industrial History (e)....	3
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	17 or 18

## MECHANIC ARTS.

## Short Course.

## FIRST YEAR.

First Semester.		Second Semester.	
English Composition (a) .....	4	English Composition (a) .....	4
Algebra (a) ....	4	Algebra (a) .....	4
Mechanical Drawing (l).....	4	Mechanical Drawing (m).....	4
Woodwork (a) .....	4	Carpentry (a) or Pattern	
Forge Work (b) ....	4	Work (e)....	4
		Forge Work (c) or Foundry (d)	4
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	20		20

## SECOND YEAR.

English (b) .....	4	English (b) ..	4
Plane Geometry (c) .....	4	Plane Geometry (c)....	4
Mechanical Drawing (n) .....	4	Mechanical Drawing (n).....	4
Physics (a) .....	4	Physics (a).....	4
Elective .....	4	Elective....	4
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	20		20

Electives: Carpentry, forge, machine work, pattern making, foundry, steam boilers and engines, steam and gas engines.

## DESCRIPTION OF THE WORK.

## ENGLISH.

(a) **English Composition.**—The aim of the course is to secure accurate and effective expression, and to afford constant exercise in composition. In connection with this work English classics will be made the subject of class room study, forming a basis for the study of literature. I and II. 1 unit.

(b) **Rhetoric.**—This is a continuation of course (a). Each student is required to do considerable written work beside work in the text book. I and II. 1 unit.

(c) **Literature.**—The object of this course is to develop an intelligent appreciation of American and English masterpieces and to promote a taste for the best literature. A series of classics similar in number and kind to the New English College requirements are the material for critical class room study. The student will find in the library valuable works of reference. Some written work will be required. I and II. 1 unit.

(d) **Critical Study.**—The purpose of this course is to apply the principles as laid down in composition and rhetoric. It will consist of a study of the classics, writing of themes, oral discussions and library and home reading assignments. I and II. 1 unit.

## MATHEMATICS.

(a) **Algebra.**—This includes the following subjects: Addition, subtraction, multiplication, division, equations of the first degree with one unknown number, simultaneous equations of the first degree, factors, highest common factor, lowest common multiple, quadratic equations, simultaneous equations above the first degree, theory of indices (positive, negative, fractional, and zero), and radicals. I and II. 1 unit.

(b) **Advanced Algebra.**—Simultaneous quadratic equations; ratio proportion and variation; graphical representation of simple relations between two variables; arithmetical and geometrical progressions; binominal theorem for positive integral exponents; logarithms, including use of tables in simple numerical work. I.  $\frac{1}{2}$  unit.

(c) **Plane Geometry.**—This includes, in addition to the work given in the standard texts, a large number of original exercises. Prerequisite: Algebra (a). II. 1. 1 unit.

(d) **Solid Geometry.**—In this course special attention is given to the geometry of the sphere. Prerequisite: Algebra (a) and (b) and geometry (c). II.  $\frac{1}{2}$  unit.

## SCIENCE.

(a) **Elementary Physics.**—Lectures with experimental illustrations, recitations, assigned problems, and laboratory work four hours



per week throughout the year, in mechanics, sound, heat, light, electricity and magnetism. Text book: A First Course in Physics, by Millikan & Gale. I and II. 1 unit.

(a) **Biology.**—This course will be conducted in such manner as to give the pupils a well balanced course in elementary botany. The object of the course is not to train botanists, but rather to give the student a foundational knowledge of botanical science and its bearing on every day life. Recitations, demonstrations and laboratory. I,  $\frac{1}{2}$  unit.

(e) **Elementary Physiology.**—An elementary course in physiology covering the main facts of general anatomy and physiology of the human body. Nutrition, the blood and circulation, respiration, excretion, nervous system and its function, and the special senses, are among the topics covered. II.  $\frac{1}{2}$  unit.

### GERMAN.

(a) **Beginning German.**—The work of the first year includes pronunciation, grammar, selections in prose and verse with practice in speaking and writing German. I and II. 1 unit.

(b) **Second Year German.**—Texts suitable for second year work; for the most part, the writings of contemporary authors. Memorizing of easy colloquial sentences and poems. Conversation and composition. I and II. 1 unit.

### HISTORY.

(d) **General History.**—In this course the student will study Greek and Roman history with a brief sketch of Medieval institutions as an introduction to more extended work in Modern history. He will have a text book but will also use the reference books in the library in looking up special topics. I and II. 1 unit.

(e) **Industrial History.**—A course in which our industrial development is taken up from the standpoint of boys and girls of high school age is offered as an elective. The text book in the hands of pupils will be supplemented by special topics. I and II, 6.

### DRAWING.

(a) **Drawing.**—Freehand drawing from geometric solids and casts. Study of light and shade. Object drawing, in charcoal, pencil, and pen and ink. Study of linear perspective with practical exercises in perspective sketching. I and II.  $\frac{1}{2}$  unit.

(b) **Drawing.**—A continuation of course (a) with study of design and handicraft at the discretion of instructors. I and II.  $\frac{1}{2}$  unit.

(c) **Household Decoration.**—Study of line, form and color as applied to the furnishing of a home. I.  $\frac{1}{4}$  unit.

## HOME ECONOMICS.

(a) **Sewing.**—The fundamental principles of hand and machine sewing applied to the making of aprons and undergarments—students provide suitable materials. The finished work is the property of the student. I, 2 credits; II, 4 credits.

(b) **Dressmaking.**—Designing, cutting and making simple dresses is a part of the work. I, 2 credits; II, 4 credits.

(c) **Textiles.**—A study of cotton, wool, silk and linen in regard to its microscopical structure, physical properties, manner of growth, and manufacture into cloth. Simple tests for adulteration are discussed. Sample note book is kept. I.  $\frac{1}{4}$  unit.

(d) **Embroidery.**—Embroidery of household linens and wearing apparel; weaving rugs and pillows.

(g) **Cooking.**—The object of the course is to teach plain cooking breads, meats, eggs, cereals, soups, salads, preserving fruits, cakes, candy and simple desserts. Visits to the meat market to study cuts of meat. The students are shown how biology and chemistry apply to the preparation of foods. Lecture, 2; laboratory, 2. I and II. 8 credits.

(h) **Elementary Food and Nutrition.**—This course treats of the general principles of human nutrition. Some attention is given to invalid cookery. I and II, 4 credits.

(j) **Household Management.**—This course deals with the organization of the household and expenditure of the income. A study is also made of the evolution of the home, lectures on house furnishings and exercises in making skeleton plans of small houses. I and II. 4 credits.

## MECHANIC ARTS.

(a) **Wood Work.**—Joinery, consisting of a series of exercises designed to develop skill in the use and care of bench tools, and proficiency in reading simple working drawings. Turning, comprising spindle, face plate and chuck work in the manufacture of simple patterns and standard articles for shop use. House carpentry, illustrating the methods and principles of framing, rafter and stair cutting, mill work and finishing. Cabinet work, in which standard wood shop machinery is used. I,  $\frac{1}{2}$  unit.

(b) **Forge Work.**—The operation of hand and power forges and manipulations of the fire, with progressive exercises in iron forging designed to teach the operations of drawing, upsetting, bending, forming and welding. The work of the second semester includes the forging and welding of mild and tool steels, as well as the hardening and tempering of simple hand tools. II.  $\frac{1}{2}$  unit.

(c) **Forge Work.**—A continuation of (b) in forging and tempering hand tools, lathe tools, foundry tools, springs, drills and reamers, including annealing and case-hardening. I.  $\frac{1}{4}$  unit.

(d) **Foundry.**—A course in bench and floor moulding in green

sand. Casting in white metal, brass and cast iron are poured for use in the machine shop. I and II.  $\frac{1}{2}$  unit.

(e) **Pattern Making.**—Instruction in the methods of making proper allowances on patterns for draft, shrinkage and finish, and practice in the construction of patterns for pulleys, hangers, machine parts and pipe fittings, with the necessary core boxes. I and II.  $\frac{1}{2}$  unit.

(f) **Machine Work.**—Bench work, including chipping, filing, scraping, fitting, soldering, brazing, and babbitting. Machine tool work on drill press, shaper, planer and lathe. I and II.  $\frac{3}{4}$  unit.

(h) **Machine Work.**—Students choosing this subject are given advanced work on lathe, milling machine and grinder, with practice in hardening and tempering taps, dies, cutters and high speed steels. I and II.  $\frac{1}{2}$  unit.

(l) **Mechanical Drawing.**—Lettering. The shape and proportions of letters, freehand construction. Geometrical construction, freehand sketching of simple machine parts, reproduced in detailed working drawings; orthographic projection in the third quadrant. I and II.  $\frac{1}{2}$  unit.

(m) **Mechanical Drawing.**—A continuation of (a) in machine and architectural detail drawing, tracing and blue-printing; isometric and cabinet projection; intersections and development of surfaces with applications in roof framing and sheet-metal work. I and II.  $\frac{1}{2}$  unit.

(n) **Mechanical Drawing.**—Machine drawing and the elementary principles of mechanism; screws, threads, screws and bolts; pulleys and belting; gear tooth curves, gears in train, change gears. I and II.  $\frac{1}{2}$  unit.

(o) **Mechanical Design.**—Machine drawing and elementary design, covering bearings and journals, spur, bevel and screw gears, differentials and change speed mechanism, engine parts, quick returns, punches, shears, presses. Two hours recitation, four hours drawing. I and II. 1 unit.

(p) **Steam Boilers and Practice.**—The construction and operation of steam boilers, and their auxiliaries, including the care of boilers, their strength and evaporative capacity, the physical properties of steam, combustion of fuel, pumps, injectors, feed water heaters, condensers. Prerequisites: Physics, mechanical drawing (a), (b), and machine work (f). I.  $\frac{1}{2}$  unit.

(r) **Steam and Gasoline Engines.**—The construction and operation of steam and gasoline engines and tractors; valves and valve gears, governors; lubricators; indicator cards, indicated horse power, brake horse power, efficiency. Prerequisite: (M. A. a). II,  $\frac{1}{2}$  unit.

(t) **Electrical Practice.**—Elementary principles of electricity, electric wiring, management and care of electrical machines and apparatus, including dynamos and motors, batteries, electric lights, telephones and telegraph apparatus. Text book: *Essentials of Electricity*, by Timbie. Prerequisite: Physics (a). Lectures and recitations per week. I and II.  $\frac{3}{4}$  units.

## School of Agriculture

The School of Agriculture offers practical instruction to the young men from the farms of Montana who wish to fit themselves for successful farming. The courses offered are intended as a preparation for life rather than for college. The student is brought into actual contact with the problems connected with farm life and learns that agriculture is a profession requiring both skill and knowledge if it is to be a source of pleasure and profit to the farmer.

Students in this course have the privilege of studying a modern dairy in operation, including types of the best breeds of dairy cattle; a complete poultry plant, containing breeds illustrating especially the best laying strains and market fowls; modern grain and soil laboratories; model farm buildings and barns, with pure bred live stock; the experiment station farm; greenhouses and orchards; the large biological, chemical and physical laboratories; and the well equipped wood and iron shops of the engineering department. The methods employed are practical. The instruction is supplemented with practice in the laboratories, the dairy, the orchards, the greenhouses, and with the herds. As far as practicable, visits are also made to other farms and herds in the neighborhood.

The variety of animals included upon the farm affords ample opportunity to see the various diseases, injuries, etc., encountered in farm animals. In the veterinary building there is provided a clinic room, where sick and injured animals are treated, and the student is given the benefit of these demonstrations.

The course extends through three years of six months each and comes in the winter season when the young people can be spared from farm work. For entrance to this course, students must have passed the eighth grade or its equivalent, otherwise they shall be required to pass an entrance examination or give satisfactory evidence to the school principal that they are capable of carrying on the work. Young men 21 years of age and over will be admitted to the course without having completed the eighth grade in the public school, provided they have had some practical experience upon the farm and possess a fair common school education. Those who satisfactorily complete the course will be given diplomas.

All students are charged a general fee of three dollars per semester. This fee is not returnable unless students leave early in the year on account of sickness or for other reason satisfactory to the faculty. A laboratory fee of two dollars per semester is required in dairying and one dollar a semester in biology. The shop deposit is two dollars a semester in wood working and three dollars a semester in blacksmithing. The total cost to the student will be about \$150 to \$175 a year. This will include board, room, text books and fees.



**SCHOOL OF AGRICULTURE.  
FIRST YEAR.**

First Semester.

English (Eng. f).....	4
Arithmetic (Math. a) .....	4
Physics (Phys. b).....	5
Animal Types (An. Ind. a)....	2
Carpentry (M. A. a) .....	2
Mechanical Drawing (M. A. a) 2	

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Second Semester.

English (Eng. f) .....	4
Agricultural Botany (Biol. b). 3	
Vegetable Gardening (Hort. b) 3	
Animal Types (An. Ind. b)....	2
Farm Machinery (Agron. e)..	3
Carpentry (M. A. a).....	2
Mechanical Drawing (M. A. b) 2	

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19

**SECOND YEAR.**

English (Eng. g) .....	2
Plant Propagation and Ornamental Horticulture (Hort a) 4	
Field Crops (Agron. a).....	4
Irrigation and Drainage (Agron f) .....	2
Breed Types (An. Ind. c)....	2
Farm Poultry (An. Ind. e)....	3
Forge (M. A. b).....	2

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19

English (Eng. g) .....	2
Chemistry (Chem. a) .....	5
Field Crops (Agron. b).....	4
Breed Types (An. Ind. d)....	2
Farm Dairying (An. Ind. f)..	4
Forge (M. A. b).....	2

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19

**THIRD YEAR.**

English (Eng. h) .....	2
Farm Management and Accounting (Agron. d) .....	4
Fruit Growing (Hort. c).....	3
Feeding and Management (An. Ind. g) .....	3
Animal Breeding (An. Ind. i)..	3
Common Diseases (Vet Sci. k) 4	

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19

English (Eng. h) .....	2
Soils (Agron. c) .....	4
Plant and Insect Pests (Biol. c).....	4
Feeding and Management (An. Ind. h) .....	3
Dairy Manufacture (An. Ind. j) 3	
Farm Motors (M. A. s) .....	3

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**AGRONOMY.**

(a) **Field Crops.**—This course includes a study of the methods of growing and producing oats, wheat, flax, rye and corn. First semester, 4 credits. 3 lectures and 1 laboratory.

(b) **Field Crops.**—This includes a study of all forage crops, and grasses. Second semester, 4 credits, 3 lectures and 1 laboratory. Prerequisite: Agronomy (a).

(c) **Soils.**—This course considers the formation and classification of soils, and includes a study of tillage and the methods for keeping up the soil's productiveness. First semester, 4 credits.

(d) **Farm Management and Accounts.**—In this course students are taught the practical methods of managing a farm. Second semester, 4 credits.

(e) **Farm Machinery.**—This course includes a study of the various types of farm machinery. Special emphasis is laid on the selection, adjustment and care of farm machinery. The course will also include instruction on the modern farm conveniences, such as telephones, water supply systems, etc. Second semester, 3 credits. Prerequisite: Physics (d).

(f) **Irrigation and Drainage.**—Includes a study of the different methods of irrigating and draining land. First semester, 2 credits. Prerequisite: Physics (b).

**ANIMAL INDUSTRY.**

(a) **Animal Types.**—A study of the market types of cattle and sheep. First semester, 2 credits, 2 laboratories.

(b) **Animal Types.**—Judging of the market types of dairy cattle, horses and swine. Second semester, 2 credits, 2 laboratories.

(c) **Breed Types.**—Includes a study of the breed types of cattle and sheep. First semester, 2 credits, 1 lecture and 1 laboratory. Prerequisites: Animal Industry (a) or (b).

(d) **Breed Types.**—Includes a study of the breed types of dairy cattle, horses and swine. Second semester, 2 credits, 1 lecture and 1 laboratory. Prerequisites: Animal Industry (a) or (b).

(e) **Farm Poultry.**—A study of the various breeds and their adaptability to farm use. Housing, feeding, incubation and brooding will also be taken up. The laboratory time will be spent in judging birds, operating incubators and brooders, and making a study of such poultry problems as time will permit. Lecture, 1; laboratory, 2. First semester.

(f) **Farm Dairying.**—Includes a study of the methods of handling cream and butter upon a small dairy farm. Second semester, 3 credits, 2 lectures and 1 laboratory.

(g) **Feeding and Management of Live Stock.**—In this course the student receives instruction as to the different methods of feeding and managing cattle and sheep. They are also taught the different methods by which these animals are prepared for the show ring. First

semester, 3 credits, 2 lectures, and 1 laboratory. Prerequisites: Animal industry (c) and (d).

(h) **Feeding and Management of Live Stock.**—A study of the methods of feeding, showing and managing horses and hogs. Second semester 3 credits, 1 lecture and 2 laboratories. Prerequisites: Animal Industry (c) and (d).

(i) **Animal Breeding.**—This course includes a study of the principles of breeding as directly applied to the farm. Cross breeding, inbreeding and line breeding are taken up. First semester, 3 credits. Prerequisites: Animal Industry (c) and (d).

(j) **Dairy Manufacture.**—This course includes a study of the creamery methods of making butter and cheese. Second semester, 3 credits, 1 lecture and 2 laboratories. Prerequisite: Animal Industry (f).

(k) **Common Diseases.**—The aim in this course is to first give the student lectures upon the physiology of the digestive, respiratory and blood vascular systems in order to prepare him for a more comprehensive study of the common diseases. It also includes a study of the various kinds of wounds and their treatment, general conformation and care of the teeth and some of the more common ailments in all species of domestic animals. During the second semester, lectures will be given on the care and handling of breeding animals and accidents and diseases attendant upon parturition. 4 credits first semester.

## HORTICULTURE.

(a) **Plant Propagation and Ornamental Horticulture.**—A study of the various methods of plant propagation with special reference to the methods of multiplying fruit and ornamental plants. The latter part of the course deals with the simple principles of ornamental planting and ornamental plants adapted to Montana conditions. First semester. 4 credits.

(b) **Vegetable Gardening and Small Fruit Culture.**—This course deals with methods of growing, gathering, storing, and marketing the more important vegetable crops; hotbed construction and management; and with the growing of such small fruits as the strawberry, raspberry, blackberry, currants, and gooseberry. Second semester. 3 credits.

(c) **Orcharding.**—The subjects of selecting the sites, planning and planting, cultivation, irrigation, pruning, and general care of the orchard are discussed, more especially from the standpoint of the home orchard. First semester. 3 credits. Prerequisite: Horticulture (a).

## BIOLOGY.

(b) **Agricultural Botany.**—The elements of botany are taken up, especially with a view to the needs of agricultural students. The classification, structure, physiology and ecology of plants, are briefly

covered. Special attention is given to farm weeds. Second semester, 3 credits, 2 lectures.

(c) **Insect Pests and Plant Diseases.**—A study of the more common pests and diseases of plants found in Montana together with methods of preventing or controlling them. Second semester, 4 credits, 4 lectures. Professors Cooley and Swingle.

### PHYSICS.

(b) **Elementary Physics.**—Includes experimental lectures, recitations and assigned problems on mechanics, heat, light and electricity. Emphasis will be placed upon those subjects that have a direct bearing on applied agriculture. First semester, 5 credits.

### CHEMISTRY.

(a) **Elementary Chemistry.**—Includes a study of the fundamental principles of chemistry and their relation to agriculture. Second semester, 5 credits.

### ENGLISH.

(f) **English Exercises.**—The first year is devoted to practice in spelling, punctuation, note taking, letter writing, and the simpler forms of composition. The work is based on Hanson's Two Years in English. First and second semesters. 4 credits each semester.

(g) **English Composition.**—This includes a study of the paragraph and its development, sentence structure and words. Much practice in oral and written composition is required. A few masterpieces are read as a basis for a careful study of good style. First and second semesters. 2 credits each semester.

(h) **Composition and Literature.**—The course for the third year provides for a brief study of the forms of literature. The study and writing of narration, description, exposition, and argument is required. At least one good example of each of the four forms of composition is studied in class. First and second semesters; 2 credits each semester.

### MATHEMATICS.

(a) **Industrial Arithmetic.**—The purpose of this course is to develop skill and accuracy in the fundamental processes of arithmetic and relate the work to farm experience. The student will be prepared to handle the mathematical problems connected with the work of the shop and laboratory. First semester, 4 credits.

**MECHANIC ARTS.**

(a) **Carpentry.**—The use and care of carpentry tools. A series of exercises in joinery, followed by practice in framing and rafter and stair cutting. First year, first semester, 2 credits, 2 laboratories; second semester, 2 credits, 2 laboratories.

(b) **Blacksmithing.**—Care and manipulation of fire, iron forging, including the operation of drawing, upsetting, pointing, bending, welding, calculation of stock; implement repairs, plow pointing, manufacture of chains, hooks, clevises, clips, etc. Second year, first semester, 2 credits, 2 laboratories; second semester, 2 credits, 2 laboratories.

(k) **Mechanical Drawing.**—The elements of lettering, use of tools in simple geometrical constructions, isometric orthographic representations, working drawings. Farm building construction; plans, elevations, framing details, bills of material. Details of forms for concrete work, silo construction, plumbing and sanitation. Farm maps. Text: "Agricultural Drafting," Howe. Laboratory, 4. I and II.

(s) **Farm Motors.**—A study of the various motors adapted to use on the farm, particularly the gas engine, with practice in operating and locating troubles. Tractor practice and study of simple stationary installations. Lecture, 1; laboratory, 2.

## School of Music

PAUL P. McNEELY, Mus. B. (Washburn College); A. B. (University of Kansas); Lhevinne, Berlin.

Director of School of Music and Instructor in Piano and Musical Theory

U. HOLMES BISHOP (New England Conservatory of Music).

Instructor in Voice and Conductor of Singing Organizations.

FRED O. JACKSON (National Conservatory of Music).

Instructor in Violin and Conductor of Orchestra.

MISS JUNE HARTMAN, B. S., (Montana State College).

Instructor in Piano and Organ.

LOUIS L. HOWARD (Boston Conservatory of Music.)

Director of Band and Instructor in Band Instruments.

### ADVANTAGES OF COLLEGE INSTRUCTION.

The advantages of college over private instruction are very numerous and quite obvious to any one giving the matter serious thought. When a student is seeking the services of a private teacher, he must form his judgment as best he can on that person's fitness for his vocation, while it is certain that the teachers of a successful college are selected mainly on account of their ability, as it would not be in the best interests of such an institution to sacrifice its reputation by employing other than good teachers. Again, the stimulating atmosphere of a music school is another distinct advantage over private instruction.

The music departments are organized for a four-fold purpose:

1. To combine music and literary studies as a broad basis for regular collegiate instruction.
2. To use the art of music for intellectual, esthetic, and moral culture.
3. To teach all branches of music to special and general students.
4. To educate teachers of music.

### DEPARTMENTS OF INSTRUCTION.

- I. Course for the pianoforte.
- II. Course for the voice.
- III. Course for the violin.
- IV. Course for the organ.
- V. Course for harmony, counterpoint, analysis, and history of music.
- VI. Course for orchestral and band music.
- VII. Instruction in chorus singing.

### GENERAL INFORMATION.

1. No time limit can be designated for the satisfactory completion of any course on account of difference in degree of musical ability;



much also depends upon the preparation made, and upon the amount of time and careful attention the student can devote to the pursuit of a chosen study.

2. Students who present themselves as candidates for graduation must have completed a high school course or its equivalent and give evidence of a requisite musical talent and capacity. Each student must give during the last year of study one public recital in addition to the final performance at the commencement concert. Students preparing for graduation are required to take two private lessons a week for two years at least with the head teacher of the department, and it is necessary that resident students should study with teachers of the college for at least two years.

3. For graduation, four semesters' work in harmony will be required, and one year in the history of music, and a thesis.

4. The study of music has been placed upon an equality with other electives, and a limited number of credits may be counted toward a degree.

5. Diplomas will be granted to students who have done satisfactory work and passed the required examinations.

6. Tuition rates are payable in advance for each term of twelve weeks. No reduction will be made for temporary absence from lessons or for lessons discontinued. Lessons missed by the teacher will be made up at the mutual convenience of teacher and pupil.

7. All college students who take work in music shall be enrolled in at least twelve credits of work (including, if so assigned, work in harmony and musical history) in addition to the work in vocal and instrumental music. Students residing at home may be excused by the faculty from such requirements, upon request of their parents. Work is recommended in home economics, languages, literature, history and art.

Students not candidates for a preparatory diploma or a college degree, who are taking music in combination with other work of the college, shall be registered by the head of the department of home economics.

Those students not taking other college work are classed as "Music Specials."

8. The department is closed on the college and national holidays. Lessons falling on these days will not be made up.

9. No student is permitted to take part in any public performance without consent of the director.

10. Tuition fees are subject to change from year to year.

#### EQUIPMENT.

The School of Music of the college occupies half of the third floor of College Hall. The large assembly room is used for recitals. The school is well equipped with pianos, both grand and upright.

## CONCERTS AND RECITALS.

Concerts are frequently given by the instructors and advanced students.

Recitals are given bi-monthly by the students of the school, at which work studied in the class room is performed before a small audience of fellow students and friends. Every student is required to take part in the programs at least twice a year. These semi-public appearances are of great assistance in enabling the student to acquire the ease and self-possession so essential to a successful public performance.

## ENSEMBLE AND SIGHT PLAYING.

In this branch of instruction lie indispensable elements of musical culture, to be obtained through no other mode of training.

Ensemble training develops the pupils' ability in reading at sight, and enables them to acquire a knowledge of compositions ordinarily inaccessible to the pianoforte student.

Prima-vista reading of four-hand arrangements, and transcriptions of the symphonies, operas, string quartettes and chamber music generally, for two pianos, are studied. Piano accompaniment playing for voice, violin and other solo instruments receives special attention.

During the year, one or more ensemble recitals are given.

## PIANO DEPARTMENT.

The regular course in piano-forte is covered by five grades, Preparatory, Freshman, Sophomore, Junior and Senior; and the Post Graduate course by one. Examinations will be held twice a year—at the end of each semester. Regular students may not pass from any grade without examination. While it is not obligatory for students to take these examinations, yet they are encouraged to take them because they have something definite before them, their ambition is stimulated and a better quality of study is secured. The pieces used for these examinations will be chosen from a list arranged by the director of the music department.

Special attention will be paid to the following points in the examinations:

Excellence of technique.

Accuracy of notation and correctness of fingering.

Phrasing and rhythm.

Discretion in use of pedals.

Choice of tempo and steadiness in time.

Quality of touch and tone.

Artistic interpretation.

Memory playing.

## PREPARATORY PIANO COURSE.

Technical exercises—Hanon and later Philipp, throughout all courses. Czerny-Germer, Studies II; Duvernoy, School of Mechanism, op. 120; Koehler, op. 50; Heller, op. 45 and 47; Kuhlau's Kinderleben; Sonatas by Clementi and Kuhlau.

## COLLEGIATE PIANO COURSE.

## Freshman Examinations.

Candidates must be prepared to play from memory six pieces or sonatas, such as Mendelssohn's Songs without Words; Schubert's Impromptus; Sonatas by Haydn and Mozart; or other appropriate selections from classic and modern compositions.

**Technic.**—All scales, hands together, in quarter, eighth, and sixteenth, separately, staccato and legato; triads in all keys; arpeggios in three positions, hands separately.

**Studies.**—Czerny, School of Velocity; Cramer, Studies; Bach, Two-part Inventions, and French Suites.

## Sophomore Examinations.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, and one number of the eight must be prepared without assistance.

Appropriate selections from classic and modern compositions will be studied including Beethoven's Sonatas; Concertos by Mozart, Hummel, etc.

**Technic.**—All scales, hands together, in quarter, eighth and sixteenth notes, metronome at 69. Triads and four-note chords with different touches. Arpeggios formed on all major and minor triads with their inversions, metronome at 84, hands separately. Staccato octaves in any scale required.

**Studies.**—Cramer, Studies, continued; Clementi, Selections from Gradus ad Parnassum; Jansen, op. 32; Bach, Three-part Inventions and English Suites.

## Junior Examinations.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number of the eight must be prepared without assistance.

Concert selections from classic and modern composers will be studied including Chopin's Preludes; Bach, Well-Tempered Clavichord; Concertos by Beethoven, Mendelssohn, etc. Selections from Henselt's op. 2 and 5.

**Technic.** Major and minor scales, hands together, similar and

contrary motion, metronome at 105. Also major scales, hands together in thirds, sixths, and tenths, metronome at 100. All chord forms, Arpeggios formed on the major and minor chords and on the diminished seventh chords, with inversions, metronome at 92. Staccato octaves in major and minor keys, hands together.

Studies.—Gradus continued; Moscheles, *Etudes*, op. 70; Kullak, *School of Octaves*; Chopin, *Etudes*.

#### Senior Examinations.

Candidates must be prepared to play from memory eight pieces selected by the instructor, one number of which must be by Bach, one by Beethoven, and one by Chopin or Schumann. One number must be a concerto. One number of the eight must be prepared without assistance.

Concert selections from Schumann's greatest works (David, Bunte-Tanze or Carnival); Sonatas and Concertos by Beethoven, von Weber, Greig, etc., and pieces by modern composers.

Technic.—All major and minor scales in octaves, tenths, sixths, and thirds, metronome at 120. Scales must also be played with crescendos and diminuendos, two notes against three, and three notes against four. All chord forms, solid and broken, with any touch required. Arpeggios formed on all major and minor chords, also the dominant seventh, and diminished seventh chords, all with inversions, metronome at 108. All octave forms will be required.

Studies.—Chopin's *Etudes*, op. 10 and 25; Rubinstein, *Selected Studies*; Bach, *Well-tempered Clavichord*, continued.

#### Post Graduate Examinations.

Candidates must be prepared to play eight numbers selected by the instructor. One post graduate number of the eight must be prepared by the candidate without assistance.

The most advanced works in the piano repertory will be studied, as Chopin's *etudes* and Godowski's arrangement of same; modern *etudes* by Liszt, McDowell, Moszkowsky, etc. Transcriptions of Bach's organ pieces by Liszt, Busoni, etc.; Schumann's *Etudes Symphoniques* or a set of Brahms' *Variations*; concert pieces and concertos by modern composers.

Technic.—All scales in similar and contrary motion, the legato in quarter, eighth, and sixteenth notes; staccato (hand and finger touch) in quarter and eighth notes, metronome at 176. All chord forms, solid and broken, metronome at 160. Arpeggios on all major and minor chords; also dominant seventh chords, with inversions, the legato in quarter, eighth and sixteenth notes; staccato (hand and finger touches) in quarter and eighth notes. The seventh chords to be played also in triplet rhythms, metronome 176. Octaves in major, minor and chromatic scales, hands together, in similar motion, with

any variety of touch required. The staccato in quarter, eighth and sixteenth notes; the legato and arm touches in quarter and eighth notes only. All major, harmonic, minor and chromatic scales in double thirds, fourths and sixth legato and staccato.

### MUSICAL THEORY.

The courses in harmony presupposes a thorough knowledge of the rudiments of music and some proficiency in piano playing.

The following courses are required of all students in the regular musical courses, excepting courses 5 to 9, which are optional:

(1) **Harmony.**—The study of overtones, scales, intervals, triads, and seventh chords and their inversions. The practical work consists of harmonizing melodies in soprano or bass and playing chord progressions at the piano. First year, twice a week first semester.

(2) **Harmony.**—The study of close and open harmony, dominant ninth and diminished seventh chords, modulations. Practical work continued. First year, twice a week, second semester.

(3) **Harmony.**—The study of modulation, irregular resolutions, altered chords, suspensions, passing tones, organ point, harmonization of florid melodies. Practical work continued. Second year, twice a week, first semester.

(4) **Musical Analysis.**—Review of harmony, analysis of two and three part song and song with trio. Classical models with original work. Second year, twice a week, second semester.

(5) **Counterpoint.**—The different orders of single counterpoint in two, three, and four parts. Third year, once a week, first semester.

(6) **Counterpoint.**—Double and triple counterpoint. Counterpoint in the twelfth and fifteenth and in more than four parts. Modern counterpoint. Third year, once a week, second semester.

(7) **Musical Composition.**—The theme and variation, dance and song forms. Analysis of classical models and practical work. Third year, first semester.

(8) **Musical Composition.**—The sonata and rondo forms; analysis of classical sonatas; original work. Third year, second semester.

(9) **Musical History.**—A survey of music from the earliest times. Lectures, discussions, and assigned readings. First year, once a week, first semester.

(10) **Musical History.**—This course deals principally with modern music. Lectures, reports and class discussions. First year, once a week, second semester.

(11) **Thesis.**—All candidates for graduation in any department of the school of Music must write a creditable thesis on some phase of music or the other allied arts.

### VOCAL DEPARTMENT.

Instruction in this department aims to develop a high musical taste and ability in the singer, as well as in the voice. Along the



course of study is voice placement, vowel study and their application to words; rhythm, phrasing, enunciation, and song interpretation. Songs are selected from the works of the best writers, both foreign and native. Studies in vocalization include works of Concone, Vaccai, Sieber, Machesi, Lutgen, etc.

No student of the vocal art can reasonably expect to achieve any great degree of proficiency without a certain amount of general culture. To this end, harmony should be studied; languages, especially German, French and Italian; a good command of English is necessary; chorus work is of an almost indispensable value; and every singer should be able to play on the piano song accompaniment of moderate difficulty.

Candidates for graduation must have completed an accredited high school course or its equivalent; must be able to sing intervals, scales, arpeggios and sustained tones; must have completed one year each of harmony and history of music; two years each of French and German languages and one year of Italian for which Spanish may be substituted; two years of piano (secondary); two years of chorus if required; and must be able to read at sight with a reasonable degree of accuracy. The repertoire should be extensive so as to include compositions of the French, German and Italian masters, as well as those of the English and American writers of note.

**Chorus.**—The choruses are the Male Glee Club and the Ladies Glee Club. The aim of these organizations is to promote college life and spirit and give the students opportunity to develop musically. From time to time public exhibitions are given of the works studied.

**Male Glee Club.**—Men students who have the necessary range and quality of voice are admitted. Music and instruction is free. Rehearsals are held twice a week under the direction of the instructor of vocal music. College and home songs as well as the works of the foremost American composers are studied.

**Ladies' Glee Club.**—This club consists of sixteen voices, otherwise it corresponds with the Male Glee Club. The same type of music is studied, and the rehearsals are held twice a week. Twice a year the clubs appear in joint concerts performing the works studied, and forming also a mixed chorus. Separate appearances are frequent.

#### VIOLIN DEPARTMENT.

The work of the violin department is covered by five grades. Preparatory, Freshman, Sophomore, Junior, and Senior. Examinations will be held twice a year at the end of each semester and it will be necessary for the student to play six major and their relative minor scales in one, two and three octaves, according to the grade of the student. Also one study selected by the instructor on day of examination and one study prepared by the student.

**Preparatory Violin Course.**

Dancla; Conservatory Method, Books I and II; Dancla, School of Velocity; Schradieck, Major and Minor Scales in one octave; Dancla and Mazas, Special Sight-reading Duos.

**Collegiate Violin Course.****Freshman.**

**Technic.**—Scales in two octaves. Scales in double stopping thirds and sixths.

**Studies.**—Mazas, Etudes Speciales, Book I; Schradieck, Exercises to increase firmness in different positions; Dancla, op. 122; Hans Litt. op. 32, Book II; ensemble playing.

**Sophomore.**

**Technic.**—Scales in three octaves, double stopping in thirds, sixths and octaves.

**Studies.**—Mazas, Etudes Brilliantes, Book II; Schradieck exercises for double stopping, Book II; Etudes by Singer, Allard, David, interspersed with compositions of Raff, Beethoven, Dancla, Bohm, etc. Ensemble playing.

**Junior.**

**Technic.**—Scales in three octaves. Scales in double stopping in thirds, sixths, octaves and tenths.

**Studies.**—Mazas, Etudes d'Artistes, Book III; Hans Litt, op. 80, Twenty-four studies in different keys (preparatory to Kruetzer Studies); Kreutzer, Forty-two Studies; Compositions by DeBeriot, Bach, David, Vieux temps, etc.; Sonatas by Mozart. Ensemble work from the best masters.

**Seniors.**

**Technic.**—Scales in three octaves. All double stops and chromatics.

**Studies.**—Rode, Twenty-four caprices; Florillo, Thirty-six Etudes; Compositions by Mendelssohn, Dvorak, Brahms, Moszkowski, etc. Sonatas by Beethoven. Ensemble playing from the best masters.

**The Orchestra.**—All violin students who are sufficiently advanced are admitted to the College Orchestra and in as much as the orchestra is under the personal direction of the violin instructor it is of a decided advantage to the violin students.

**Ensemble.**—In this department, sonatas for piano, and violin by Bach, Beethoven, Mendelssohn, Schumann, Mozart, Hayden, Schubert, Greig, Rubinstein and others are used; also many classical compositions of different forms. This department is open to advanced piano students only.

## CALENDAR FOR 1914-15.

The music department has divided the year into three terms of twelve weeks each, or if desired, lessons may be arranged by the College semester.

1914—September 7: Fall term registration begins.

November 30: Fall term closes.

December 1: Winter term begins.

1915—February 23: Winter term closes.

February 23: Spring term begins.

June 2: Spring term closes.

## TUITION.

With Mr. McNeely.

For one forty-five minute lesson per week for one term.....	\$25.00
For two half-hour lessons per week for one term.....	32.00
Harmony, for the entire academic year (two lessons a week).....	20.00

With Miss Hartman.

For one forty-five minute lesson per week for one term.....	18.00
For two half-hour lessons per week for one term.....	22.00
Organ, one hour lesson per week for one term.....	24.00

With Mr. Bishop.

One thirty minute lesson per week for one term.....	\$18.00
Two half-hour lessons per week for one term.....	36.00

With Mr. Jackson.

For one forty-five minute lesson per week for one term.....	\$18.00
For two half-hour lessons per week for one term.....	25.00
For one hour ensemble lesson per week for one term.....	18.00

Students wishing to arrange for vocal or instrumental instruction by the single lesson instead of by the term will be charged \$1.50 per half-hour lesson.

Piano practice may be arranged for at the following prices:

One hour each day 30 cents per week.

Organ practice: One hour each day, 25 cents.

## Alumni

**With their Years, Degrees and Present Addresses and Occupations.**

- Alderson, Myrtle, B. S., 1913; Assistant to the Dean of Women, Oregon Agricultural College, Corvallis, Oregon.
- Allen, Elbert, B. S., 1903; Attorney at Law, Livingston, Mont.
- Alward, Mary L., B. S., 1908; Teacher in Gallatin County High School, Bozeman, Montana.
- Annin, James T., B. S., 1911; Part owner Columbus News, Columbus, Montana.
- Baker, Florence, B. S., 1912; Deceased.
- Baker, Harold E., B. E. E., 1907; Superintendent Electric Power Co., Naches, Washington.
- Bancroft, Raymond E., B. S., 1911; Fruit and Orchard Inspector, Billings, Montana.
- Barnard, Robert B., B. S., 1910; Salesman Westinghouse Electric Co., Butte, Montana.
- Bell, James C., B. S. 1911; Superintendent of Fruit Farm, Bitter Root Valley, Darby, Montana.
- Benton, Ralph, B. S. 1906; Associate Professor of Applied Biology, University of Southern California, Los Angeles.
- Blessing, John, B. S., 1912; Orchardist, Victor, Montana.
- Bole, Margaret, B. S., 1913; Clerk, Bozeman Daily Chronicle office, Bozeman, Montana.
- Bole, William S., B. S. 1906; Physician and Surgeon, Bozeman, Montana.
- Booker, Clinton T., B. S., 1911; Electrical Engineer, Great Falls Power Company, Butte, Montana.
- Blankenship, E. V., B. S., 1897; Farming and Stock Raising, Bozeman, Montana.
- Brabrook, Ralph, B. S., 1913; Allotment Engineer, Carraway, Florida.
- Brewer, Lucille, B. S., 1909; Matron Woman's Hall, University of Montana, Missoula, Montana.
- Breneman, Annie T., B. S., 1907; Instructor in Mathematics, Teton County High School, Choteau, Montana.
- Brook, Thomas B., B. S., 1913; Machinist in Garage, Twin Bridges, Montana.
- Brown, Archie S., B. S., 1910; Electrical Expert, Bremerton Navy Yards, Bremerton, Washington.
- Brown, Edith E., B. S., 1904; Mrs. John Milloy, Regina, Canada.
- Bull, Edna, B. S., 1909; Mrs. W. G. Kirscher, Townsend, Montana.
- Bull, Frieda M., B. S., 1907; M. S. 1909; Instructor in Mathematics, Montana State College, Bozeman, Montana.
- Burke, Edmund, B. S., 1907; Chemist and Meteorologist, Montana Agricultural Experiment Station, Bozeman, Montana.
- Butter, Donald, B. S., 1909; Electrical Engineer, General Electric Co., Schenectady, N. Y.

- Caldwell, Thomas O., B. A. C., 1899; Leasing on Gold Reef and Maginnis Mine, Lewistown, Montana.
- Carr, Irene H., B. S., 1911; Mrs. Claude Meserve, North Bridgetown, Maine.
- Carmichael, Effie, B. S., 1910; Mrs. Vergil A. Spicer, Red Oak, Iowa.
- Chaffee, Sarah, B. S., 1906; Mrs. Rudolph Beseke, Rathdrum, Idaho.
- Clark, Ben A., B. S., 1911; Acting Chief Engineer, Butte, Anaconda & Pacific railroad, Anaconda, Montana.
- Clark, Grace, B. S., 1911; Instructor in Home Science in Girls' Mission School, Old Umtali, Rhodesia, Africa.
- Clark, Olive, B. S., 1913; Dietitian, St. Peter's Hospital, Helena, Montana.
- Cockrel, Irvin, B. A. C., 1900; Osteopath Physician, New York City.
- Collins, Walter E., B. S., 1902; Trust Officer, State Savings Bank and Practicing Attorney, Butte, Montana.
- Cooke, Amy, B. S., 1908; Mrs. George Ambrose, Mackay, Idaho.
- Cook, George, B. S., 1912; Assistant in Extension Work, Agronomy Department, Montana State College, Bozeman, Montana.
- Cowan, Lewis, B. C. E., 1904; Civil Engineer, Bozeman, Montana.
- Dawes, Rhoda, B. S., 1913; Instructor in Home Science, Sweet Grass County High School, Big Timber, Montana.
- Daly, Freeman A., B. S., 1912; Railroad Topographer, Stearns, Montana.
- Davidson, Mary E., B. S., 1910; Sedan, Montana.
- DeMuth, David R., B. S., 1910. Deceased.
- Douglas, Stanley, B. S., 1913; Missouri River Power Company, Hauser Lake, Montana.
- DeMuth, Maud S., B. S., 1907; Mrs. W. D. Tallman, Bozeman, Montana.
- Donaldson, Noble C., B. S., 1912; Assistant in Grain Investigation of U. S. Department of Agriculture, Moccasin, Montana.
- Draper, Charles H., B. S., 1912; Editor Carbon County Journal, Red Lodge, Montana.
- Driscoll, William J., B. S., 1908; Civil Engineer, Lawrence, Mass.
- Dusenbury, Inez, B. S., 1912; Rudyard, Montana.
- Edsall, William, B. S., 1911; Switchboard Expert, Westinghouse Electric Co., New York City.
- Edwards, Margaret, B. S., 1912; Instructor in Domestic Science, Fergus County High School, Lewistown, Montana.
- Edwards, Timothy, B. S., 1909; Civil Engineer, Hauser Lake, Montana.
- Ellis, Edward M., B. S., 1911; General Electric Company, Los Angeles, California.
- Fisher, Charles M., B. S., 1908; Electrical Engineer, Washington Water Power Company, Spokane, Wash.
- Fisher, Helen, B. S., 1910; Mrs. Fred Willson, Bozeman, Montana.
- Flager, Harold, J., B. E. E., 1907; Electrical Engineer, Seattle Electric Co., Seattle, Wash.
- Flager, Howard A., B. E. E., 1906; Business, Mount Vernon, Wash.
- Flager, Ruth, B. S., 1910; Mrs. Carl Widener, Bozeman, Montana.
- Flaherty, Charles D., C. E., 1904; Engineer, Livingston, Montana.



- Foster, Florence, B. S., 1896; Mrs. Burton Fleming, Iowa City, Iowa.
- Fox, Hazel, B. S., 1910; Mrs. Byram Mayfield, Enterprise, Oregon.
- Freeman, Beatrice, B. S., 1900; Mrs. Thomas S. Davis, Columbus, Mont.
- Freeman, W. B., B. C. E., 1903; in charge of Irrigation and Drainage for the government of Siam.
- Froebe, Frank J., B. S., 1911; Local Representative of E. B. Clark Seed Co., Bozeman, Montana.
- Gardiner, Henry C., B. S. A., 1903; Veterinarian and Agriculturist, Anaconda Copper Mining Company, Anaconda, Montana.
- Gordon, Fred E., B. S., 1913; Assistant Manager Land Department, Anaconda Copper Mining Company, Anaconda, Montana.
- Gottschalk, Carl, B. S., 1909; M. S., 1910; Assistant in Chemistry, Montana State College, Bozeman, Montana.
- Griffith, Warren J., B. E. E., 1907; Clerk, Spokane, Wash.
- Hagerman, Edna, B. S., 1912; Instructor in Home Science, Great Falls, Montana.
- Haines, Will T., B. S., 1911; Instructor in Electrical Engineering and Physics, Montana State College, Bozeman, Montana.
- Ham, Frank W., B. S., 1903; M. S., 1905; Professor of Physics, Montana State College, Bozeman, Montana.
- Hamilton, Everett A., B. S., 1911; Operator Madison River Power Co., Norris, Montana.
- Hartman, Brooks, B. S., 1913; Bookkeeper, Empire Bank and Trust Company, Lewistown, Montana.
- Hartman, June, B. S., 1910; Instructor in Music, Montana State College, Bozeman, Montana.
- Hartman, Lois, B. S., 1907; Instructor in Domestic Science, University of Utah, Salt Lake City, Utah.
- Hartman, Ruth, B. S., 1913; Teacher of Music, Sheridan, Montana.
- Hartman, Will, B. S., 1908; Crookes and Hartman, Engineers, Livingston, Montana.
- Hawkins, P. H., M. S., 1903; Banker, Absarokee, Montana.
- Henderson, Charles F., B. S., 1910; Westinghouse Electric Co., Pittsburgh, Pa.
- Henderson, Lisle, B. S., 1909; Electrical Engineer, Montana Reservoir and Irrigation Company, Helena, Montana.
- Higgins, Lucille, B. S., 1911; M. S., 1912; Mrs. C. S. Norton, Jr., Bozeman, Montana.
- Hind, Bert S., B. S., 1909; Superintendent Power Plant, Madison River Power Company, Norris, Montana.
- Hinman, Ruth, B. S., 1912; Teacher, Forsythe, Montana.
- Hodgkiss, John E., B. S., 1912; M. S., 1913; Farmer, Choteau Montana.
- Hutton, Fred, B. E. E., 1902; Deceased.
- Jacobs, Lillian, B. S., 1910; Mrs. Arie DeGroot, Three Forks, Montana.
- James, John S., B. S., 1909; Civil Engineer, Hauser Lake, Montana.
- Jones, Burle J., B. S., 1904; Manager Orangewood Nursery Company, Phoenix, Arizona.
- Jones, Kyle, B. S., 1912; Rancher, Choteau, Montana.

- Jones, Wyatt Wagner, B. S., 1901; M. S., 1902; Plant Pathologist and Agricultural Expert, Berkeley, California.
- Kennedy, Cyril C., B. S., 1910; Power Plant Operator, Great Falls Power Company, Great Falls, Montana.
- Kimpton, Addie, B. S., 1910; Radersburg, Montana.
- King, Lowell, B. S., 1904; Construction Engineer, Electric Railroad, Davenport, Iowa.
- King, Ruby E., B. S., 1909; Mrs. George Hogan, Bozeman, Montana.
- King, Willard V., B. S., 1911; Investigating Spotted Fever Tick for Bureau of Entomology, U. S. D. A., Florence, Montana.
- Kinney, Edward C., B. C. E., 1907; Chief of Construction United States Reclamation Service, Ganado, Arizona.
- Kirk, Grace, B. S., 1911; Instructor in Domestic Science, Bozeman Public Schools, Bozeman, Montana.
- Kirk, Mary E., B. S., 1906; Mrs. Ermine Potter, Corvallis, Oregon.
- Kirscher, W. Guy, B. S., 1909; County Surveyor, Broadwater County, Townsend, Montana.
- Koch, Elers, B. S., 1901; Supervisor Forest Service, Missoula, Montana.
- Kremer, William J., B. S., 1910; Hydraulic Engineer, Madison Land and Irrigation Company, Bozeman, Montana.
- Lamme, Maurice A., B. S., 1903; Director of Geology and Mineralogy, Government University, Montevideo, Uruguay, S. A.
- Lannin, Earl A., B. S., 1912; Montana Power Company, Butte, Montana.
- Lewis, Edna, B. S., 1903; Instructor in Mathematics, Gallatin County High School, and Member of County Board of Examiners, Bozeman, Montana.
- Livingston, Walter, B. S., 1910; Civil Engineer, U. S. Reclamation Service, Great Falls, Montana.
- Locke, Jerome G., B. C. E., 1908; C. E., 1910; Surveyor General of Montana, Helena, Montana.
- Larentz, Floyd S., B. E. E., 1907; E. E., 1910; Rancher, Stanford, Montana.
- Luther, J. Glenn, B. S., 1912; Electrical Engineer Conray Placer Mining Company, Ruby, Montana.
- Mackay, Warren, B. S., 1913; General Electric Company, Lynn, Mass.
- Maynard, Edna, B. S., 1900; M. S., 1903; Mrs. Garfield T. Morris, San Francisco, California.
- McCraw, John L., B. S., 1912; Deceased.
- Metheney, Blanche, B. S., 1911; Demonstrator, General Electric Co., Billings, Montana.
- Millegan, Guy J., B. S., 1912; Homesteader and Farmer, Millegan, Montana.
- Monforton, Zee, B. S., 1901; Mrs. Dr. H. C. Patterson, National City, California.
- Moore, Ellie J., B. S., 1901; Farmer, Bozeman, Montana.
- Morgan, George W., B. S., 1912; Scientific Assistant, Office Forage Crops Investigation, Bureau of Plant Industry, Department of Agriculture, Washington, D. C.

- Morgan, Joseph D., B. S., 1912; Assistant in State Grain Laboratory, Bozeman, Montana.
- Morgan, Oliver P., B. S., 1896; Deceased.
- Morris, Elwood, B. S., 1909; Assistant Botanist and Bacteriologist, Montana Agricultural Experiment Station, Bozeman, Montana.
- Morris, Garfield T., B. C. E., 1903; Senior Civil Engineer in the Valuation Department, Interstate Commerce Commission, Pacific Division, San Francisco, California.
- Mountjoy, Agnes, B. S., 1907; Mrs. Harry Mickelson, Opheim, Montana.
- Mountjoy, Irvin, B. E. E., 1908; Homesteader, Cardwell, Montana.
- Nash, Lewis, B. S., 1904; Farmer, Clyde Park, Montana.
- Noble, Erma, B. S., 1909; M. S., 1910; Teacher, Broadwater County High School, Townsend, Montana.
- Osborne, Belle, B. S., 1907; Mrs. D. E. Fish, Adel, Iowa.
- Pease, Jay L., B. C. E., 1907; Farmer, Bozeman, Montana.
- Peck, Harry L., B. S., 1911; Westinghouse Electric Co., Wilkesburg, Pa.
- Penwell, Clyde C., B. S., 1906; B. E. E., 1907; Electrical Engineer, Cement Factory, Trident, Montana.
- Penwell, Clyde W., B. E. E., 1909; Electrical Engineer, Montana Power Co., Great Falls, Montana.
- Peters, Orville S., B. S., 1909; E. E., 1912; Assistant Physicist, Bureau of Standards, Washington, D. C.
- Peterson, James A., B. S., 1909; Attorney at Law, St. Paul, Minnesota.
- Philpott, June, B. S., 1911; M. S., 1912; Teacher, Yamhill, Oregon.
- Piedalue, Irene, B. S., 1911; Bozeman, Montana.
- Piedalue, Laura, B. S., 1912; Instructor in Sewing, Helena High School, Helena, Montana.
- Pool, Louis K., B. S., 1910; City Engineer, Townsend, Montana.
- Potter, Ermine L., B. S., 1906; Professor Animal Husbandry, Oregon Agricultural College, Corvallis, Oregon.
- Quaw, Eugene C., B. S., 1911; Playwright, Bozeman, Montana.
- Quaw, Lucille, B. S., 1903; Teacher of Home Science, Y. W. C. A., Portland, Oregon.
- Quaw, Mignon, B. S., 1902; Instructor Gallatin County High School, Bozeman, Montana.
- Quaw, Thomas B., B. S., 1907; Principal of Joliet Public School, Joliet, Montana.
- Reese, Herbert J., B. S., 1904; Long Beach, California.
- Robinson, J. W., B. S., 1908; Grain Buyer for McCaull-Dinsmore Co., Bozeman, Montana.
- Sacket, Nathalie, B. S., 1913; Secretary, Public Highway Commission, Helena, Montana.
- Sacket, Charles T., B. C. E., 1904; C. E., 1907; Consulting Civil Engineer, Livingston, Montana.
- Sales, Reno H., B. S., 1898; Geologist, Anaconda Copper Co., Butte, Montana.
- Schabarker, W. W., B. M. E., 1902; Night Foreman, Shops, Milwaukee R. R., Milwaukee, Wis.

- Schmidt, F. W., B. S., 1903; Superintendent Cyanide Plant, Xiririca, San Paule, Brazil, S. A.
- Seamans, Arthur, B. S., 1913; Assistant in Dry Land Department, U. S. Department of Agriculture, Akron, Colorado.
- Shaw, W. T., B. S., 1896; Unknown.
- Shovell, William L., B. S., 1912; Horticultural Expert, Bitter Root Irrigation Co., Hamilton, Montana.
- Sloan, J. Harvey, B. C. E., 1903; In Public Service Commission, Madison Wisconsin.
- Sloan, W. F., B. E. E., 1903; Public Service Commissioner, Madison, Wisconsin.
- Sloan, William Glenn, B. S., 1910; Government Drainage Engineer, Boise, Idaho.
- Smith, Alda, B. S., 1913; Teacher of Home Science, Belt Public Schools, Belt, Montana.
- Snider, Leta, B. S., 1911; Mrs. James A. Peterson, St. Paul, Minn.
- Soper, Joseph, B. S., 1913; Bozeman, Montana.
- Spain, Marvin, B. S., 1911; Homesteader, Sand Springs, Montana.
- Spain, Whitfield, B. S., 1909; Manager of ranch, Belgrade, Montana.
- Spragg, Frank A., B. S. A., 1902; Plant Breeder of Farm Crops for the Michigan Experiment Station, Lansing, Michigan.
- Stafford, Lucy B., B. S., 1896; Mrs. William Peck, Pony, Montana.
- Taylor, John C., B. S., 1912; County Agriculturist, Fallon County, Ekalaka, Montana.
- Tavener, Frank C., B. C. E., 1903; Construction Engineer, Montpelier, Idaho.
- Thompson, Homer C., B. S., 1902; Principal of High and Grade Schools, Three Forks, Montana.
- Thorpe, Mabel A., B. S., 1907; Mrs. J. A. Thaler, Bozeman, Montana.
- Thorpe, Elizabeth, B. S., 1907; Teacher in Public Schools, Ogden, Utah.
- Tracy, Edna, B. S., 1908; Mrs. John White, Bozeman, Montana.
- Tremper, William G., B. S., 1911; U. S. Deputy Surveyor, Helena, Montana.
- Truman, Joseph K., B. S., 1913; Bozeman, Montana.
- Vreeland, Edna, B. S., 1909; Shay's Cafeteria, Los Angeles, Calif.
- Wade, Arthur M., B. S., 1911; Fireman, Chicago, Milwaukee & Puget Sound R. R., Three Forks, Montana.
- Walchli, Fred, B. S., 1910; Head Engineer for the Electric Power and Ice Plant, Sterling, Colorado.
- Widener, Carl C., B. S., 1908; City Engineer, Bozeman, Montana.
- Whorton, John C., B. S., 1913; Stock Business, Wisdom, Montana.
- Willey, Leroy, B. S., 1913; Dry Land Office, U. S. Department of Agriculture, Archer, Wyoming.
- Williams, Frank B., B. M. E.; Engineer, State School for Deaf and Blind, Boulder, Montana.
- Williams, Lee, B. E. E., 1902; County Surveyor, Powell County and City, Engineer, Deer Lodge, Montana.

- Williams, Roy B., B. S., 1911; U. S. Reclamation Service, St. Ignatius, Montana.
- Williams, Sidney A., B. S., 1911; Westinghouse Electric Co., Wilkesburg, Pennsylvania.
- Wilson, Elva, B. S., 1909; Teacher, High School, Three Forks, Montana.
- Wilson, Walter, B. S., 1913; Westinghouse Electric Co., Pittsburg, Pa.
- Wolpert, Harold E., B. S., 1912; Working in Smelter, Mullen, Idaho.
- Wylie, Lawrence, B. S., 1913; Westinghouse Electric Co., Pittsburg, Pa.
- Wylie, Mary, B. S., 1910; Homesteader, Portage, Montana.

## SCHOOL OF MUSIC GRADUATES.

- Alexander, Maud, Piano, 1913, Student, M. S. C.....Bozeman, Mont.
- Alward, Coda, Piano, 1908.....Polson, Mont.
- Bancroft, Alma J., Piano, 1911, Mrs. Roy Straum.....Bozeman, Mont.
- Benge, Faith, Piano, 1910.....Winterset, Iowa.
- Brown, Edith, Piano, 1906, Mrs. John Milloy.....Regina, Canada.
- Featherston, Ellis, Piano, 1907, Music Supervisor...Mattewan, N. Y.
- Freeman, Lorraine, Piano, 1906, Teacher.....Bozeman, Mont.
- Griffin, Grace, Piano, 1907, Mrs. W. C. Blythe.....Whittier, Cal.
- Griffith, Gladys M., Piano, 1913, Student.....Minneapolis, Minn.
- Hartman, Flora, Piano, 1907, Teacher.....Bozeman Mont.
- Hartman, June, Piano, 1910; Teacher M. S. C.....Bozeman, Mont.
- Hartman, Ruth, Piano, 1913, Teacher.....Sheridan, Mont.
- Hollier, Georgia, Piano, 1912; Student.....Bozeman, Mont.
- Lovelace, Amy, Vocal, 1908, Mrs. Geo. Rittenhouse....Williams, Ariz.
- Maynard, Frances, Piano, 1909, Mrs. Ed. Howard....Bozeman, Mont.
- Piedalue, Alice, Piano, 1908, Mrs. C. W. Hancock....Lewistown, Mont.
- Stanton, Grace, Piano, 1901, Mrs. W. B Walker.....Missoula, Mont.
- Sales, Zada, Piano, 1912, Student.....Bozeman, Mont.
- Schumacher, Hettie, Piano, 1912, Teacher.....Bozeman, Mont.
- Waters, Mary, Piano, 1902, Mrs. H. L. Houston, Teacher..Helena, Mont.
- Widener, Carl, Vocal, 1908; City Engineer.....Bozeman, Mont.
- Work, Vida, Piano, 1909, Mrs. Ray Holloway.....Bozeman, Mont.



## Degrees Granted June, 1913

### MASTER OF SCIENCE.

Hodgskiss, J. Edward.....Agronomy

### BACHELOR OF SCIENCE.

Alderson, Myrtle.....History-Literature  
 Bole, Margaret.....Mathematics-Physics  
 Brabrook, Ralph.....Civil Engineering  
 Brooks, Thomas.....Mechanical Engineering  
 Clark, Olive.....Home Economics  
 Dawes, Rhoda.....Home Economics  
 Douglas, Stanley.....Electrical Engineering  
 Gordon, Fred.....Agronomy  
 Hartman, Ruth.....Home Economics  
 Hartman, W. Brooke.....Mathematics-Physics  
 McKay, Warren.....Electrical Engineering  
 Sacket, Nathalie.....Civil Engineering  
 Seamans, Arthur.....Agronomy  
 Smith, Mary Alda.....Home Economics  
 Soper, Joseph.....Horticulture  
 Truman, Joseph.....Electrical Engineering  
 Wharton, John.....Agronomy  
 Willey, Leroy.....Agronomy  
 Willson, Walter.....Electrical Engineering  
 Wylie, Laurence.....Electrical Engineering

### MUSIC.

#### Diploma.

Alexander, Maud.....Bozeman  
 Griffith, Gladys.....Bozeman  
 Hartman, Ruth.....Bozeman

# Names of Students, 1913-14

## Post Graduates.

Bull, Frieda.....	Art .....	Bozeman
Grieve, D. W.....	Chemistry .....	Billings
Smith, Inez M.....	Home Economics .....	Bozeman
Widener, Carl C.....	Chemistry.....	Bozeman

## Seniors.

Buckley, Thomas W.....	Civil Engineering .....	Manhattan
Cullum, Georgia M.....	Home Economics....	Helena
Dissly, Frederick L.....	Agronomy, ....	Sugar Creek, Ohio
Eckles, Mildred A.....	Home Economics ....	Forsyth
Everett, Inez.....	Home Economics .....	Big Timber
Fowler, Viola .....	Secretarial .....	Bozeman
Flanders, Clara M.....	Home Economics .....	Bozeman
Hodgskiss, Wm. L.....	Agronomy .....	Choteau
Heighton, Pearl A.....	Home Economics .....	Choteau
Harmon, Ella M.....	Home Economics .....	Bozeman
Hansen, Chas. L.....	Agronomy ....	Bozeman
Hill, Lewis L.....	Civil Engineering .....	Livingston
Kiefer, James A.....	.....	Bozeman
Kenck, Max W.....	Electrical Engineering .....	Butte
Leinard, Ford B.....	Agronomy.....	Bryan, Ohio
Millegan, Homer D.....	Animal Industry ....	Millegan
Martin, Claude A.....	Civil Engineering .....	Stockett
Papke, William C.....	Civil Engineering .....	Bozeman
Richter, Frederick A.....	.....	Bozeman
Roecher, Rausie.....	Home Economics ....	Bozeman
Scnumacher, Frederick W.....	Agronomy, .....	Baker, Oregon
Switzer, Phyllis Madge .....	Home Economics.....	Bozeman
Solberg, Selmer H.....	Electrical Engineering...	Big Timber
Truitt, Chas. Alonzo.....	Civil Engineering .....	Bozeman
Vestal, Wm. B. Jr.....	Civil Engineering...	Indianapolis, Ind.
Webster, R. Alden.....	Electrical Engineering .....	Bozeman

## Juniors.

Abell, Tracy H.....	Horticulture .....	Bozeman
Border, Ernest J.....	Animal Industry.....	Bozeman
Batch, Otto C.....	Animal Industry.....	Helena
Burkett, Alonzo.....	Chemistry .....	Bozeman
Coffey, Hazel.....	Home Economics .....	Bozeman
Dahl, Hilmer L.....	Mechanical Engineering.....	Belt
Davidson, Lyndall.....	Chemistry .....	Bozeman

Eberle, Alfred.....	Agronomy .....	Butte
Fiske, John.....	Electrical Engineering .....	Helena
Goodson, Anne .....	Home Economics .....	Livingston
Gray, Florence.....	.....	Bozeman
Gray, Charles.....	Animal Industry .....	Bozeman
Grimes, Walter.....	Civil Engineering .....	Bozeman
Hollier, Georgia.....	Secretarial .....	Bozeman
Jacobs, Edward.....	Electrical Engineering ...	Delta, Colo.
Jones, Ray S.....	Chemistry .....	Livingston
Kennard, Eveleen.....	Home Economics .....	Kinsey
Kelly, Robert T.....	Civil Engineering .....	Anaconda
Larson, Elmer N.....	Civil Engineering .....	Livingston
Lott, Mortimer J.....	Animal Industry .....	Twin Bridges
Morgan, Carl F.....	Civil Engineering .....	Joliet
Malsor, Roy E.....	Civil Engineering .....	Anaconda
Maddox, W. E. ....	Animal Industry .....	Gove, Kan.
Myers, Ada Mae.....	Home Economics .....	Billings
Noble, Edward.....	Animal Industry .....	Whitehall
Pettigrew, Leslie.....	Civil Engineering .....	Great Falls
Piedalue, Aimee.....	Secretarial .....	Bozeman
Potter, John V.....	Electrical Engineering, W. Sul. Spgs.	
Pool, Florence.....	Home Economics .....	Townsend
Roosevelt, George A.....	Agronomy .....	Ackley, Iowa
Steele, W. Hamilton.....	Electrical Engineering ...	Great Falls
Thompson, A. Paul.....	Chemistry .....	Bozeman
Taylor, Emma Louise.....	Home Economics.....	Bozeman
Whipple, Chas. A.....	Animal Industry .....	Helena
Wilcomb, Max J.....	Civil Engineering.....	Twin Bridges
Wilson, Kathleen.....	Home Economics .....	Bozeman

### Sophomores.

Anderson, Albert.....	Secretarial .....	Bozeman
Allen, Mollie J.....	Home Economics .....	Butte
Alexander, Maud.....	Secretarial .....	Bozeman
Borthwick, Alberta.....	Home Economics .....	Hamar, N. D.
Connor, Vivian S.....	Agriculture .....	Choteau
Carr, Myron S.....	Agriculture .....	Bozeman
Clarkson, Robert.....	Agriculture .....	Chinook
Cotner, Victor.....	Civil Engineering.....	Lovell, Wyo.
Cooley, Esther Belle.....	Home Economics .....	Bozeman
Chestnut, Lulu M.....	Home Economics .....	Havre
Dehnert, A. W.....	Civil Engineering.....	Denton
Fletcher, Elizabeth.....	Home Economics .....	Twin Bridges
Ford, Arthur.....	Mechanical Engineering ....	Helena
Heagney, Wm. F.....	Agriculture .....	Bozeman
Hibbard, Harrell H.....	Agriculture .....	Helena

Kelly, Martin E.....	Civil Engineering .....	Anaconda
Kinsella, Olive A.....	Home Economics .....	Bozeman
Larson, Mary E.....	Home Economics .....	Boulder
Lessel, Erma M.....	Home Economics.....	Butte
Lescher, Taylor.....	Electrical Engineering....	Great Falls
McRoberts, Edith.....	Home Economics .....	Bozeman
Miewald, Ethel.....	Home Economics .....	Chinook
Milburn, George R.....	Civil Engineering .....	Butte
Mills, Gwendolyn.....	Home Economics .....	Helena
Miller, Oscar.....	Electrical Engineering .....	Bozeman
Osenburg, Albert.....	Agriculture .....	Butte
O'Connor, Wm. O.....	Agriculture .....	Red Lodge
Riddell, Marsa.....	Home Economics .....	Helena
Stone, Hurford E.....	Secretarial .....	Indianola, Iowa
Steel, David A.....	Civil Engineering .....	Great Falls
Seamans, Howard .....	Biology .....	Wauwatosa, Wis.
Sweat, Ruth.....	Home Economics .....	Great Falls
Stanley, Amelia.....	Home Economics .....	Great Falls
Stanley, Adelaide.....	Secretarial .....	Great Falls
Sutherland, Edward.....	Civil Engineering .....	Whitcomb
Wight, Florence.....	Secretarial, ..	White Sulphur Springs
Walker, Cecil.....	Home Economics .....	Bozeman

## Freshmen.

Abrahamson, Irene V.....	Home Economics .....	Red Lodge
Armstrong, Nina.....	Secretarial .....	Big Timber
Beeman, Ogden F.....	Civil Engineering.....	Dillon
Beerstecher, Ada.....	Home Economics.....	Belgrade
Burch, Marguerite.....	Home Economics .....	Kalispell
Bunnell, Ercell.....	Mechanical Engineering....	Bozeman
Bullock, Fred.....	Agriculture.....	Bozeman
Carpenter, Ethel.....	Home Economics.....	Great Falls
Clark, May.....	Home Economics .....	Bozeman
Crest, Signa.....	Secretarial .....	Big Timber
Cooley, George A.....	Agriculture .....	Bozeman
Cole, E. Lester.....	Agriculture .....	Butte
Cook, Chas. W.....	Civil Engineering .....	Roundup
Crittenden, Floyd S.....	Agriculture.....	Bozeman
Duncan, Ray.....	Agriculture .....	Belgrade
Duquette, Jay.....	Electrical Engineering.....	Potomac
DeCamp, Renan.....	Electrical Engineering.....	Helena
Elliott, Mae.....	Secretarial .....	Hyfield
Fluhr, Wm.....	Agriculture .....	Helena
Fox, Arthur.....	Agriculture .....	Kalispell
Fowler, Edith.....	Home Economics.....	Great Falls
Fletcher, Ruth.....	Home Economics .....	White Sulphur Spgs.

Fey, Lulu.....	Home Economics .....	Stearns
Fricke, Alice A.....	Secretarial .....	Huntley
Goff, Clifford.....	Electrical Engineering..	Flat Rock, Ill.
Gatton, S. S.....	Agriculture .....	Bozeman
Garvin, John.....	Electrical Engineering.....	Helena
Garnier, Camille.....	Secretarial .....	Livingston
Hodgskiss, Ursula.....	Home Economics .....	Choteau
Hoem, Arthur.....	Mechanical Engineering.....	Butte
Havens, Donald D.....	Electrical Engineering .....	Chinook
Hudson, Herbert C.....	Civil Engineering .....	Sheridan
Ingram, Chas. C.....	Electrical Engineering.....	Helena
Jackman, E. Russell.....	Agriculture .....	Kalispell
Jaeckel, Carl O.....	Agriculture .....	Anaconda
Jorgenson, Ralph W.....	Agriculture .....	Fox
Johnson, Albion.....	Electrical Engineering ...	Great Falls
Jolley, Lewis C.....	Civil Engineering .....	Bozeman
Kountz, Josephine.....	Home Economics .....	Bozeman
Krum, James.....	Agriculture .....	Columbus, Ohio
Kretlow, Mary P.....	Home Economics .....	Helena
Kelly, Robert J.....	Agriculture .....	Conrad
Kinsella, Thos. J.....	Chemistry .....	Bozeman
Kneale, Morris T.....	Civil Engineering.....	Bergen, N. Y.
Kirschner, Hortense.....		Bozeman
Kirk, Marguerite.....		Bozeman
Lacklen, Hester V.....		Bozeman
Langohr, Don.....	Agriculture .....	Bozeman
Leverich, John W.....	Mechanical Engineering.....	Creston
Lund, Janelle.....		Three Forks
Lund, Helen.....		Three Forks
Linfield, Bertil.....	Agriculture .....	Bozeman
Ladenberg, Carl.....	Electrical Engineering.....	Columbia Falls
Marigold, March.....	Home Economics .....	Kalispell
Mitchell, Ruth.....	Secretarial .....	Bozeman
Morgan, Eva.....	Home Economics .....	Joliet
Manning, J. M. W.....	Agriculture .....	Great Falls
McSpadden, F. Everett.....	Agriculture .....	Missoula
Miller, Joseph A.....	Biology .....	Chinook
Monson, William.....	Civil Engineering .....	Ovando
McIver, Grace.....	Home Economics .....	Great Falls
Milnor, Estella.....	Chemistry .....	Troy
Nordquist, Clark.....	Agriculture .....	Bozeman
Noble, Ruth A.....	Secretarial.....	Great Falls
Noble, Mary Viola.....	Home Economics .....	Whitehall
Orvis, Worth.....	Agriculture .....	Salesville
Perring, Maud.....	Home Economics .....	Bozeman
Preston, Edward C.....	Electrical Engineering...	Stevensville
Pink, Wm. J.....	Mechanical Engineering...	Silver Star



Potter, J. Earle.....	Electrical Engineering.....	Miles City
Papke, Emil.....	Electrical Engineering.....	Bozeman
Rapatz, Eugene.....	Electrical Engineering.....	Havre
Rice, Hubert.....	Mechanical Engineering.....	Kalispell
Riordan, Emmet.....	.....	Waterbury, Conn.
Ronne, Edwin M.....	Electrical Engineering.....	Chinook
Schattenberg, Adolph.....	Agriculture.....	Boerne, Texas.
Stahlford, Ruby.....	Home Economics.....	Hamilton
Stanton, Iva.....	English.....	Bozeman
Steen, Nels.....	Agriculture.....	Ryegate
Stevens, Frank.....	Electrical Engineering.....	Fort Benton
Stewart, Mildred.....	Home Economics.....	Bozeman
Sontag, Nadine R.....	Home Economics.....	Miller, S. D.
Strand, Roy.....	Agriculture.....	Helena
Snow, Manford L.....	Agriculture.....	Marion, Ohio
Scholton, Henry.....	Mechanical Engineering.....	Big Timber
Street, Eugene.....	Agriculture.....	Bozeman
Schumacher, Gladys.....	.....	Bozemna
Scott, Parke F.....	Agriculture.....	Armstead
Spain, Helen.....	.....	Bozemna
Selleck, Glenn.....	Electrical Engineering.....	Stevensville
Taylor, Radford.....	Agriculture.....	Bozeman
Truman, Ida R.....	Home Economics.....	Bozeman
Timmons, Carl A.....	Biology.....	Havre
Turner, R. Willson.....	Mechanical Engineering.....	Bozeman
Thomas, David S.....	Civil Engineering.....	Great Falls
Tubbs, Palmer.....	Civil Engineering.....	Elkhorn, Wis.
Thompson, W. Talbot.....	Electrical Engineering.....	Bozeman
Undem, Louis.....	Agriculture.....	Chicago, Ill.
Waltermire, Wallace.....	Agriculture.....	Kearney, Neb.
Wagner, Loren L.....	Mechanical Engineering.....	Big Timber
Wagar, J. D.....	Mechanical Engineering.....	Kalispell
White, Sylver J.....	Biology.....	Augusta
Whiteside, John.....	Electrical Engineering.....	Kalispell

## Irregulars.

Barnes, Helen.....	Bozeman
Brooks, Lucy Edith.....	Bozeman
Imes, J. W.....	Bozeman
Jones, Albert.....	McAllister
Livingston, Mildred.....	Bozeman
McKinney, Eva.....	Meadow Creek, Wis.
Maxwell, Laura.....	Bozeman
Robinson, Mrs. J. W.....	Bozeman
Trzcenski, J. J.....	Miles City

## PREPARATORY.

## Fourth Year.

Erwin, Kent.....	Mechanic Arts.....	Bozeman
Finlay, William.....	Mechanic Arts.....	Bozeman
Ford, Albert D.....	Mechanic Arts.....	Bozeman
Gerber, Elsie.....	Home Economics.....	Sand Coulee
Nelson, Albert.....	Mechanic Arts.....	Helmville
Pope, Alger.....	Mechanic Arts.....	Bozeman
Schowe, Wm. A.....	Mechanic Arts .....	Dillon
Smith, Inez F.....	Home Economics .....	Bozeman

## Third Year.

Callaway, Miriam.....	Home Economics .....	Virginia City
Fuqua, Winnifred.....	Home Economics .....	Twin Bridges
Harris, Earl.....	Mechanic Arts .....	East Helena
Kammerer, Sophia.....	Home Economics .....	Bozeman
Lehfeldt, Hedwig.....	Home Economics .....	Broadview
McLaughlin, Lorene.....	Home Economics .....	Helena
Porter, Willim H.....	Mechanic Arts .....	Roundup
Stone, Parker.....	Mechanic Arts.....	Bozeman
Stone, Frank.....	Mechanic Arts.....	Bozeman
Stone, Louise.....	Home Economics .....	Bozeman

## Second Year.

Badgley, Jerome.....	Mechanic Arts.....	Belgrade
Beach, Ben.....	Mechanic Arts .....	Mitchell
Calkins, Walter.....	Mechanic Arts .....	Butte
Limbert Emmet.....	Mechanic Arts ...	Twodot
Murray, Henry.....	Mechanic Arts .....	Hobson
Murray, Joseph.....	Mechanic Arts .....	Hobson
Nelson, Oscar.....	Mechanic Arts .....	Helmville
Vadnais, Earl L.....	Mechanic Arts .....	Lewistown
Wilson, Bryan O.....	Mechanic Arts ...	Pray

## First Year.

Axtell, Lillian.....	Home Economics .....	Belgrade
Allen, Alfred.....	Mechanic Arts .....	Deerfield
Berry, Robert.....	Mechanic Arts .....	Basin
Burggroff, Mary.....	Home Economics .....	Stearns
Brissette, Delima.....	Home Economics .....	Ruby
Border, Elmer.....	Mechanic Arts.....	Bozeman
Burns, James P.....	Mechanic Arts.....	Ashland
Belisle, Willam.....	Mechanic Arts .....	Butte
Bradley, Clyde.....	Mechanic Arts.....	Bozeman
Brissette, Ovilas.....	Mechanic Arts .....	Ruby
Cole, Garnet.....	Mechanic Arts .....	Helena
Day, Leslie.....	Mechanic Arts .....	East Helena

Hyatt, Water.....	Mechanic Arts.....	Bozeman
Holliday, Frank M.....	Mechanic Arts.....	Delphine
Hatfield, Phil.....	Mechanic Arts .....	Sheridan
Jenkins, Fred.....	Mechanic Arts.....	Twin Bridges
Lorentz, Lyndon.....	Mechanic Arts .....	Toston
Lawrence, Martin.....	Mechanic Arts .....	Wilsall
Lawyer, Idella.....	Home Economics .....	Putte
Metzel, Alexander.....	Mechanic Arts .....	Alder
McKee, Anna M.....	Home Economics .....	Jeffers
Newell, Howard.....	Mechanic Arts .....	Ashland
Oswold, Fay.....	Mechanic Arts .....	Lake, Idaho
Para, Vincent.....	Mechanic Arts .....	Anaconda
Ryan, Francis.....	Mechanic Arts .....	Cold Springs
Steadman, Gladys.....	Home Economics ..	Hobson
Sparrow, Mary.....	Home Economics ..	Alder
Townshend, Harlan.....	Mechanic Arts ..	Ruby
Westerhaus, Marie.....	Home Economics ..	Jeffers
Williams, Chas. F.....	Mechanic Arts ..	Silver Star

## HOME ECONOMICS (TWO-YEAR COURSE)

Anderson, Hazel Viola.....	Lewistown
Anderson, Stella.....	Lewistown
Brooks, Lucy B.....	Bozeman
Bieler, Martha.....	Sheridan
Crum, Rachel North.....	Helena
Corbly, Gladys .....	Bozeman
Costin, Mary .....	Virginia City
Cochran, Hazel .....	Bozeman
Haines, Loretta .....	Laurin
Holgate, Alma .....	Manhattan
Johnson, Ruth....	Hall
Johnson, Maybelle....	Whitehall
Johnson, Gladys K. ....	Bozeman
Kaiser, Margaret....	Wilsal
Kimm, Weke.....	Manhattan
Lehfeldt, Martha....	Broadview
Peel, Esther.....	Virginia City
Schott, Edythe....	Butte
Thibaudeau, Mary..	Chinook
Townshend, Mabel....	Ruby
Wight, Ruth.....	Stone
Walter, Eleanor....	Sheridan
Wagnold, Caroline....	Farlington
Wilcomb, Grace....	Laurin
Young, Beatrice.....	Columbus
Young, Frances....	Columbus

## SCHOOL OF AGRICULTURE.

## Third Year.

Allphin, Fred .....	Wilsal
Carpenter, Alvin.. .....	Clyde Park
Davis, James L.....	Bozeman
Higgins, Ross.....	Ringling
Lindsay, William.....	Helena

## Second Year.

Berube, Raymond.....	Augusta
Bennett, W. O.....	Livingston
Crawford, Herbert .....	Billings
Dehler, August.....	Helena
Murray, John.....	Hobson
Selleck, Thos. J.....	Roscoe
Starz, Oscar.....	Helena
Tintinger, Lester.....	Cascade

## First Year.

Alderson, Allan.....	Birney
Brewster, Warren.....	Birney
Benson, Alfred F.....	Stevensville
Belden, Harold.....	Utica
Braun, E. J. ....	Sauremin, Ill.
Burggroff, Adolph.....	Stearns
Cowan, Rae.....	Livingston
Cowan, Alvin.....	Belgrade
Carpenter, Chester.....	Clyde Park
Eberl, J. H.....	Columbus
Fly, Earl .....	Hardin
Griswold, J. Howard.. ..	Brighton, Colo.
Gordon, A. E.....	Belgrade
Holliday, Samuel L.....	Clyde Park
Haight, Fred.....	Great Falls
Hodgson, Wm. H.....	Kalispell
Hendrickson, Henry.....	Florence
Johnson, Earl.....	Belt
Kennedy, Jesse .....	Hardin
Kimm, Henry.....	Manhattan
Kimm, R. H.....	Manhattan
Lovely, Justin D.....	Clyde Park
Lohrer, Walter.....	Corbin
Lull, John L.....	Summit, S. D.
McLean, Bruce.....	Miles City
Marks, Alfred.....	Clancy

Mallery, Samuel.....	Albert Lea, Minn.
Marks, George.....	Clancy
Mentrum, Clarence.....	Helena
Morrison, Joe.....	Salesville
Mongrain, George.....	Toston
Moreau, Hubert.....	Helena
Maier, Richard.....	Reichle
Metcalf, Claude.....	Luther
Pink, George.....	Silver Star
Reed, R. H.....	White Sulphur Springs
Rowland, Arthur .....	Bynum
Richardson, Giles B.....	Bozeman
Sullivan, Frank.....	Stevensville
Scott, George R.....	Whitchall
Tow, Raymond.....	Box Elder
Tow, Clarence .....	Box Elder
Van Essen, Cornelius.....	Stevensville
Valentine, Oliver.....	Helena
Westlake, Lowell.....	Bozeman
Wohlfrom, Burdette.....	Canyon Creek
Ward, Earl.....	Salesville
Williams, Ray .....	Bozeman
Woodley, Francis .....	Scobey
Woosley, Samuel.....	Sedan

## MUSIC STUDENTS

Accola, Grace.....	Piano .....	Bozeman
Alexander, Maud.....	Piano, Violin.....	Bozeman
Alward, Mary.....	Piano .....	Bozeman
Axtell, Lillian.....	Piano, Voice .....	Belgrade
Anderson, Hazel.....	Piano, Voice.....	Lewistown
Abell, Tracy.....	Voice .....	Bozeman
Anderson, Stella.....	Piano .....	Lewistown
Bartz, Mildred.....	Piano.....	Bozeman
Beck, Elsie.....	Piano.....	Bozeman
Border, Lela.....	Piano.....	Bozeman
Brown, Mrs. Fred.....	Piano.....	Bozeman
Blackwood, Ione.....	Piano.....	Bozeman
Bell, Frankie.....	Piano.....	Bozeman
Blose, Wilda.....	Voice .....	Bozeman
Bole, Elizabeth.....	Piano.....	Bozeman
Borthwick, Alberta.....	Voice .....	Hamar, N. D.
Bradford, Lillian.....	Voice .....	Bozeman
Branford, Henry.....	Violin .....	Bozeman
Brandenburg, Jonas.....	Violin .....	Bozeman
Brooks, John.....	Violin .....	Bozeman



Cochran, Hazel.....	Piano.....	Bozeman
Crest, Signa.....	Voice, Piano.....	Big Timber
Cunningham, Myrna.....	Piano.....	Bozeman
Clark, Louise.....	Piano.....	Bozeman
Cooley, Esther.....	Voice .....	Bozeman
Cooley, George .....	Voice .....	Bozeman
Cullum, Georgia.....	Voice, Violin.....	Helena
Coffee, Hazel.....	Violin .....	Bozeman
Davidson, Paul.....	Violin .....	Bozeman
Eckels, Mildred.....	Voice .....	Forsyth
Esgar, Rae.....	Piano.....	Bozeman
Elliott, Mae.....	Piano .....	Clara
Eberhardt, Savanah.....	Piano.....	Bozeman
Everett, Inez.....	Voice .....	Big Timber
Eberle, Alfred.....	Violin .....	Butte
Fransham, Edna.....	Piano.....	Bozeman
Ferris, Dorothy.....	Piano.....	Bozeman
Fuller, Mrs. L. E.....	Voice .....	Bozeman
Finlay, William.....	Voice .....	Bozeman
Gerber, Elsie.....	Piano .....	Sand Coulee
Gray, Florence.....	Piano.....	Bozeman
Griffin, Juanita.....	Piano.....	Bozeman
Gatton, Dorothy.....	Voice .....	Bozeman
Gray, David.....	Violin .....	Bozeman
Haines, Loretta.....	Piano .....	Laurin
Harris, Vera.....	Piano.....	Bozeman
Hartman, Leah.....	Piano, Harmony, History...	Bozeman
Higbie, Mrs. David.....	Piano.....	Big Timber
Hartman, Ruth.....	Piano .....	Bozeman
Heighton, Pearl.....	Piano.....	Bozeman
Hutchinson, Helen.....	Piano.....	Bozeman
Holgate, Alma.....	Piano .....	Manhattan
Hollier, Trena.....	Piano.....	Bozeman
Hollier, Myrtle.....	Piano.....	Bozeman
Hollier Georgia.....	Piano.....	Bozeman
Jackson, Mary.....	Piano.....	Bozeman
Johnson, Ruth.....	Piano .....	Hall
Johnson, Maybelle.....	Piano .....	Whitehall
Johnson, Gladys.....	Piano.....	Bozeman
Jones, Ray.....	Violin .....	Bozeman
Kammerer, Sophia.....	Piano, Harmony.....	Bozeman
Kennard, Evelyn.....	Piano .....	Kinsey
Kirschner, Hortense.....	Piano, History.....	Bozeman
Kountz, Josephine.....	Piano.....	Bozeman
Kimm, Weke.....	Piano .....	Manhattan
Kuntze, Henry.....	Violin .....	Bozeman
King, Phoebe.....	Voice .....	Bozeman

Lehfelddt, Hedwig.....	Piano, Voice.....	Broadview
Lehfelddt, Martha.....	Piano .....	Broadview
Linfield, Azalia.....	Piano.....	Bozeman
Lund, Janelle.....	Piano, Voice, Harmony...	Three Forks
Lyon, Mabel.....	Piano.....	Bozeman
Lyons, Hazel.....	Violin .....	Bozeman
La Bonte, Walter.....	Violin .....	Bozeman
Lessel, Erma.....	Piano .....	Butte
LeVeque, Evelyn.....	Piano.....	Bozeman
Linfield, Leila.....	Piano.....	Bozeman
Maxwell, Lora.....	Voice .....	Bozeman
Millegan, Homer.....	Voice .....	Millegan
McNeely, Paul P.....	Voice .....	Bozeman
McCay, Dorothy.....	Piano.....	Bozeman
McDonald, Aline.....	Piano.....	Bozeman
McCay, Elmyra.....	Piano.....	Bozeman
Morton, Chester.....	Piano.....	Bozeman
Myers, Ada Mae.....	Piano .....	Billings
Martin, Atha.....	Piano.....	Bozeman
Morse, Mildred.....	Piano.....	Bozeman
Murray, Henry.....	Piano .....	Hobson
Miller, Robert F.....	Violin .....	Bozeman
Nichols, Marjorie.....	Piano.....	Bozeman
Nelson, Melba.....	Piano.....	Bozeman
O'Donnell, Kathleen.....	Violin .....	Bozeman
Onslow, Alice.....	Piano.....	Bozeman
Orvis, Worth.....	Piano, Harmon .....	Salesville
Pease, Edith.....	Piano.....	Bozeman
Perks, Alyse.....	Piano .....	Manhattan
Pool, Florence.....	Piano .....	Townsend
Peel, Esther.....	Piano .....	Virginia City
Piedalue, Aimee.....	Voice .....	Bozeman
Radford, Henry.....	Violin .....	Bozeman
Roecher, Rausie.....	Voice .....	Bozeman
Roosevelt, George.....	Voice .....	Ackley, Iowa
Richter, Marion.....	Piano.....	Bozeman
Roberson, Jessie.....	Piano.....	Bozeman
Rush, Winnie.....	Piano.....	Bozeman
Seely, Evelyn.....	Piano.....	Bozeman
Seely, Mabel.....	Piano.....	Bozeman
Spieth, Joy.....	Piano.....	Bozeman
Swingle, Mrs. D. B.....	Piano.....	Bozeman
Story, Nelson, Jr.....	Violin .....	Bozeman
Sheppard, Lillian.....	Piano, Voice, Violin, Harmony	Sheridan
Smith, Ruth.....	Piano.....	Bozeman
Selin, Olive.....	Voice .....	Dutton
Steel Hamilton.....	Voice .....	Great Falls

Switzer, Madge.....	Voice .....	Bozeman
Smullen, William.....	Violin .....	Bozeman
Thibaudeau, Mary.....	Piano .....	Chinook
Thorpe, Florence.....	Piano, Harmony.....	Bozeman
Taylor, Emma.....	Piano.....	Bozeman
Townsend, Harlan.....	Voice .....	Ruby
Truitt, Alonzo.....	Voice .....	Bozeman
Walter, Lenore.....	Piano .....	Sheridan
Wilcomb, Grace.....	Piano, Voice.....	Laurin
Wilson, Kathleen.....	Piano.....	Bozeman
Wight, Ruth.....	Piano .....	Stone
Whipple, Mrs. O. B.....	Harmony .....	Bozeman
Webster, Jessie.....	Voice .....	Bozeman
Wagnold, Lena.....	Piano .....	Farmington
Wylie, Ruth.....	Piano.....	Bozeman

#### SHORT COURSE IN CIVIL ENGINEERING.

Brown, Fred.....	Bozeman
Doooust, J. F.....	Havre
Gibson, C. A.....	Red Lodge
Giboney, L.....	Havre
George, W. T.....	Dillon
Hurdle, R. T.....	Glendive
Hartman, William.....	Livingston
Kleinhesselink, B. J.....	Big Timber
Morris, Garfield.....	Bozeman
Payne, W. L.....	Virginia City
Widener, C. C.....	Bozeman

#### FARMERS' AND HOMEMAKERS' SHORT COURSES.

Allen, Samuel W. ....	Livingston
Anderson, Mrs. W. H.....	Bozeman
Anderson, W. H.....	Bozeman
Allphin, Thos.....	Wilsall
Anderson, Jas. L.....	Lewistown
Ayres, S. E.....	Bozeman
Anderson, Peter M.....	Sydney
Alspaugh, J. A.....	Livingston
Angell, Mrs. C. E.....	Belgrade
Angell, C. F.....	Belgrade
Angell, Mrs. Ray.....	Belgrade
Allphin, Mrs. Thos.....	Wilsall
Alldritt, Isaac.....	Bozeman
Allsop, Ezra.....	Bozeman
Anderson, P. J.....	Conrad

Aakjer, H. J.....	Bozeman
Aakjer, Geo. ....	Bozeman
Anderson, Mrs. P. J.....	Conrad
Aakjer, Mrs. Geo.....	Bozeman
Aakjer, Mrs. N. ....	Bczeman
Aakjer, N. ....	Bczeman
Alderson, Frank.....	Bozeman
Alderson, Chas. R.....	Anceney
Bailey, Seavey M.....	Helena
Bell, Samuel .....	Bozeman
Band, Archer J.....	Belgrade
Beebe, Mrs. Jos. J.....	Lothair
Beebe, Ralph J.....	Lothair
Bramarck, M. D.....	Maudlow
Braun, Theodore .....	Baker
Blankenship, F. H. ....	Bozeman
Barth, L. G.....	Bozeman
Blewett, John.....	Fromberg
Bull, F. W.....	Bozeman
Bumbarner, Clark.....	Belt
Bard, Nellie J.....	Belgrade
Brainard, W. D.....	Bozeman
Beall, F. E.....	Miles City
Barnes, C. M.....	Sand Springs
Breitenstein, A. J.....	Helena
Badgley, S. B.....	Salesville
Bunnell, John L.....	Bozeman
Bunnell, Clorinda .....	Bozeman
Boss, John .....	Belgrade
Bard, Harland E.....	Belgrade
Berthot, Mrs. A. G.....	Bozeman
Bates, Paul B.....	Manhattan
Carter, T. O.....	Livingston
Coon, A. R.....	Chester
Carleton, C. H.....	Maudlow
Courtney, Wm. J.....	Belgrade
Cordry, J. E.....	Bozeman
Chaney, John W.....	Bozeman
Campbell, J. S.....	Reed Point
Cromwell, M. A. ....	Missoula
Corbly, Mrs. Hattie.....	Bozeman
Chapman, A. L.....	Bozeman
Collett, John F.....	Bozeman
Cass, F. M.....	Bozeman
Catron, H. M. ....	Bozeman
Carpenter, L. M. ....	Ciyde Park
Campbell, A. W.....	Ringling

Conrow, Samuel H.....	Belgrade
Clark, J. M. ....	Bozeman
Coolley, Mrs. F. S.....	Bozeman
Cameron, E.....	Livingston
Davis, R. F.....	Willow Creek
Durgan, Thos. ....	Livingston
Dorr, Joseph .....	Helena
Dorr, Jacob H. ....	Helena
Davis, Mrs. Wesley.....	Belgrade
DeAtley, W. H.....	Clyde Park
Dorman, J. E.....	Salt Lake City, Utah
Dissly, Wm. G.....	Bozeman
Eggen, Ole .....	Absarokee
Ectar, Mrs. Delphia .....	Bozeman
Eberhart, John .....	Bozeman
Flint, Eva .....	Livingston
Flannery, Wm. ....	Belgrade
Forswall, Ellen M.....	Belgrade
Flannery, Mrs. Ida H. ....	Belgrade
Fitzsimmons, J. L.....	Three Forks
Gwynn, Mrs. Ethel.....	Loma
Gum, C. N.....	Wilsall
Greene, C. R.....	Bozeman
Gibbs, Geo. H.....	Bozeman
Giles, Carl M.....	Josephine
Garnett, J. E.....	Willow Creek
Goode, Solon L.....	Absarokee
Grant, H. P. ....	Bozeman
Gibson, S. C. ....	Bozeman
Griffin, James.....	Chinook
Gaffney, Patrick.....	Bozeman
Govins, A. G.....	Stanford
Gordan, E. G.....	Belgrade
Gwynn, J. E.....	Loma
Good, H. C.....	Logan
Gibson, Thos. ....	Belgrade
Grass, Chas. J.....	Livingston
Gunby, T. A. ....	Maudlow
Guiles, G. E.....	Bozeman
Hoot, Louis L.....	Power
Hanson, Ellery B. ....	Melville
Hogan, Chas. B. ....	Ronan
Hogan, Mrs. Maude.....	Ronan
Howe, Frank B.....	Clarkston
Hennes, Asa .....	Wilsall
Harwood, W. A.....	Willow Creek
Hammaker, Mrs. U. W.....	Florence



Hamerell, E. H.....	Bozeman
Hogan, Geo. H. ....	Bozeman
Hunter, Pearl.....	Fairview
Hasty, Wm. ....	Sidney
Higgins, Geo. N. ....	Ringling
Hogan, Mrs. Geo. R.....	Bozeman
Haley, John P. ....	Sedan
Holliday, O. S.....	Clyde Park
Hoffman, Morgan .....	Belgrade
Hayden, Sam P.....	Salesville
Haley, J. S.....	Bozeman
Howard, Henry .....	Wilsall
Hutchinson, W. L. ....	Lothair
Jump, Clyde W.....	Bozeman
Jenkins, Thos. F.....	Twin Bridges
Jackson, Ernest V.....	Harrison
Jones, Walter C.....	Wise River
Jones, Mrs. W. C.....	Wise River
Jenkins, Mrs. Ira.....	Bozeman
Jarvis, W. F.....	Bozeman
Knowles, Ferdinand F.....	Hunters' Hot Springs
Knudson, Christian.....	Bozeman
Kerchman, L. C.....	Belgrade
Knudson, Chris .....	Bozeman
Kimpton, A. C.....	Ismay
Kimpton, Mrs. A. C.....	Ismay
Kimpton, E. A.....	Toston
Kimpton, Mrs. E. A.....	Toston
Kremer, Frank .....	Bozeman
Kirschner, J. W.....	Bozeman
Kirk, C. D. ....	Salesville
Kirk, Thos. S. ....	Bozeman
Kremer, John H.....	Straw
Kinne, H. S. ....	Livingston
Leach, Martin .....	Bozeman
Larson, Swan .....	Livingston
Lebre, Joseph .....	Harlowtown
Lewis, G. M. ....	Manhattan
Lee, Farnham C.....	Willow Creek
Larggrith, Theo. G. ....	Bozeman
Morehead, Junius H.....	Cascade
Mellotte, O. E. ....	Livingston
McLeod, Mrs. David .....	Bozeman
Morehead, Helen .....	Cascade
Mellotte, Mrs. O. E.....	Livingston
Moulton, E. J. ....	Jefferson City
Matthew, Clarence T.....	Bozeman

Monforton, Reme.....	Bozeman
Mackay, Dan C. ....	Miles City
Metier, Mrs. Geo.....	Belgrade
Metier, Geo. ....	Belgrade
Myers, Neil W.....	Billings
Miles, S. H. ....	Salesville
Miller, Hiram A. ....	Clyde Park
Mack, Walter H. ....	Willow Creek
Miles, Jason D. ....	Wilsall
Matthew, Herman ....	Bozeman
Miller, Chas. ....	Belgrade
Muir, Wm. G. ....	Logan
Mehlberg, Frank ....	Reed Point
Marks, Irving ....	Clancy
Mongold, Claude ....	Three Forks
McCampbell, Wm. ....	Clyde Park
Martin, Geo. O. ....	Two Dot
Moore, Fred M.....	Burlington, Iowa
Murray, Catherine.....	Bozeman
Moore, W. T. ....	Manhattan
Nelson, Andrew ....	Livingston
Norris, Benton ....	Bozeman
Nelson, John L.....	Fort Shaw
Nash, Wm. J. ....	Bozeman
Nash, Mrs. Wm. J. ....	Bozeman
Nutt, R. S. ....	Sydney
Norton, Mrs. C. S. ....	Bozeman
Norton, C. S. ....	Bozeman
Niebel, Matt ....	Bozeman
Olson, John L. ....	Bozeman
Olson, Ole J. ....	Bozeman
Parkes, Mrs. F. W. ....	Belgrade
Pope, Harold ....	Miles City
Phelps, Eugene ....	Meeteetse, Wyo.
Peets, John M. ....	Bozeman
Pearson, Albert J. ....	Bozeman
Patton, Arthur.....	Manhattan
Porter, Gray ....	Wayne
Penwell, M. W. ....	Belgrade
Penwell, Mary A. ....	Belgrade
Pasha, Ronald ....	Bozeman
Parker, F. W. ....	Belgrade
Parker, Mrs. F. W. ....	Belgrade
Piercé, Edwin P. ....	Boulder
Russell, Mrs. G. H. ....	Bozeman
Redfield, Adelbert ....	Bozeman
Redfield, Donald ....	Bozeman

Rice, Percy .....	Sedan
Raines, J. W. ....	Wendell, Minn.
Roll, Henry .....	Cohagen
Robinson, Wilbur .....	Bozeman
Roecher, A. C. ....	Bozeman
Ramsey, C. L. ....	Helena
Roll, Grover C. ....	Cohagen
Roth, William .....	Bozeman
Richardson, John S. ....	Manhattan
Robinson, Mrs. J. M. ....	Bozeman
Suben, Henry .....	Helena
Smith, Hugh .....	Bozeman
Seeley, Florence .....	Bozeman
Smith, Kirk .....	Livingston
Smith, John F. ....	Livingston
Smith, F. R. ....	Kalispell
Sweat, Jack .....	Great Falls
Sweat, John A. ....	Great Falls
Smith, O. W. ....	Belgrade
Schrink, Wm. P. ....	Belgrade
Stone, D. P. ....	Belgrade
Stillman, A. Z. ....	Salesville
Schrink, Mrs. ....	Belgrade
Schrink, Emma .....	Belgrade
Stacy, Ned .....	Shirley
Story, W. D. ....	Bozeman
Sparr, Wm. M. ....	Bozeman
Stanley, E. J. ....	Whitehall
Steeves, M. D. ....	Livingston
Steeves, Mrs. M. D. ....	Livingston
Smith, Harry L. ....	Bozeman
Shorthill, Chas. A. ....	Pinecreek
Spring, Geo. W. ....	Belgrade
Street, Grace .....	Bozeman
Schumaker, E. L. ....	Two Dot
Schatz, J. H. ....	Ringling
Stevenson, Geo. C. ....	Townsend
Spain, W. W. ....	Belgrade
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Trackwell, Mrs. W. L. ....	Floweree

Thompson, W. T. ....	Bozeman
Tenney, G. W. ....	Helena
Truman, L. West.....	Dunkirk
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Van Camp, Ethel .....	Bozeman
Van Camp, Mrs. A. ....	Bozeman
Valdhim, J. G. ....	Belgrade
Walton, Mrs. Edith Cooke .....	Belgrade
Wethern, Mrs. Ernest .....	Sedan
White, Mrs. Stephen .....	Bozeman
Williams, Jos. B. ....	Manhattan
Williams, Miss Blanche .....	Bozeman
Williams, Jeannette .....	Manhattan
Weedman, H. S. ....	Shawmut
Walker, J. C. ....	Rock Creek
Williams, C. F. ....	Two Dot
Wayman, W. M. ....	Valier
Wilson, F. C. ....	Pray
Walton, Alfred O. ....	Belgrade
Walker, W. E. ....	Bozeman
Young, Mrs. Alice A. ....	Great Falls
Zweifel, Mike .....	Bozeman

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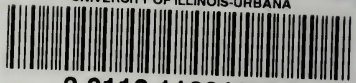








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